

A REVISION OF THE SUBGENUS *HETEROSTERNUTA* STRAND OF
HYDROPORUS CLAIRVILLE (COLEOPTERA: DYTISCIDAE)¹

JAMES F. MATTA

Dept. Biol. Sciences, Old Dominion University,
Norfolk, Virginia 23508

AND

G. WILLIAM WOLFE

Dept. Entomology and Economic Zoology, Rutgers University,
Cook College, Box 231, New Brunswick, New Jersey 08512

The nearctic species of the genus *Hydroporus* Clairville were last revised by Fall (1923). Since Fall's 1923 revision there have been several regional treatments (Young, 1954; Leech and Chandler, 1955; Gordon, 1965; Larson, 1975) and several new species have been described in the nearctic fauna. Also, Gordon has revised the *niger-tenebrosus* group (1969). Despite these studies, much remains to be done, including the clarification of species variation in several groups. The description of the larval forms and the development of life history data for most species is still to be completed.

The members of the holarctic genus *Hydroporus* are widespread and occupy a variety of aquatic habitats. They are commonly encountered at the margins of lakes and rivers, are occasionally present in large numbers in woodland pools, are frequently taken from springs, seepage areas, and occasionally from the faster flowing waters of small streams. Several species (*oblitus* group) have been taken from wells and caves.

We believe that the species allied with *pulcher* form a morphologically and ecologically related group which is sufficiently distinct to warrant subgeneric status. Wolfe and Matta (1981) have reviewed the generic and subgeneric synonymies within *Hydroporus* (with the emphasis on names applicable to Fall's (1923) *pulcher-undulatus* group). In that paper Strand's subgenus *Heterosternuta* is recognized for those species which have been known as the *pulcher* group (*sensu* Fall). Here the subgenus and its species are redescribed and a key is provided. Figures of adult color patterns, genitalia and scanning electron micrographs are provided for each species.

Materials and Methods

Extensive collecting for specimens in this subgenus was conducted in the eastern United States and the mid-south to add to the museum material available and to determine habitat preferences. Specimens were collected along margins of streams with a sturdy round or triangular framed dip net.

The most productive areas were gravelly stream margins and isolated gravel bottomed pools of water in drying stream beds. Specimens were found in streams with a substrate of bedrock in the fissures and cracks where gravel and algae accumulated. They are extremely abundant in suitable habitats and occasionally we have collected hundreds of specimens along a few feet of stream margin. Repeated vigorous scraping was often necessary and frequently more specimens were collected after the area had been thoroughly disturbed than in the initial stages of collecting.

Specimens were preserved in 80% alcohol which was changed after several hours. Dissection of genitalia was performed under a binocular microscope with jewelers forceps or a slightly hooked minuten. All drawings were done with an ocular grid and camera lucida.

It is important to observe the structure of the genitalia in alcohol as well as after they are dried and mounted on points. This is especially true for *Hydroporus laetus* Leech and *H. ouachitus* Matta and Wolfe. When wet the thin bifid tips of the aedeagus bend gently inward; however, when dry the tips flex out (Figs. 36c, 36e). All drawings in this paper are from wet specimens unless otherwise indicated. The cleft bisecting the tip of the aedeagus is often obscured in dorsal view and is best observed ventrally.

Specimens were borrowed from several individuals and museums and we would like to thank the following people for aid in obtaining specimens: Dr. G. A. Schuster (State Biological Survey of Kansas), Dr. L. L. Pechuman (Cornell University), Dr. David Larson (Memorial University of Newfoundland), Dr. Alés Smetana (Biosystematics Research Institute, Canadian National Collection), Dr. K. C. Kim (Forest Entomological Museum, Penn State University), Dr. William Hilsenhoff (University of Wisconsin), Mr. P. Severance (University of Connecticut), Dr. Paul Spangler (National Museum of Natural History), Dr. Frank Young (Indiana University), Dr. W. Brigham (Illinois Natural History Survey) and Dr. L. Herman (American Museum of Natural History). Type material from the H. C. Fall collection was generously loaned from the Museum of Comparative Zoology (Harvard University) and we thank Ms. M. M. Pearce for her assistance. We also wish to thank Mr. Nicholas Stone (Museum of Comparative Zoology) for searching through the LeConte collection for specimens of *H. oppositus*.

We especially appreciate Mr. R. E. Roughley's critical review of the manuscript. His suggestions for change and addition have increased the usefulness of this work.

Technical work involving specimen preparation and scanning electron microscope use was provided by Ms. Mary Jacque Mann and Mrs. Susan Braden.

Subgenus *Heterosternuta* Strand

Diagnosis.—The species of *Heterosternuta* are narrow, elongate oval, brightly maculate species and all possess a distinctly apically bifid aedeagus.

All but two species (*wickhami* and *oppositus*) have at least a portion of the dorsal surface of the aedeagus sclerotized.

Redescription.—Form elongate-oval (almost always twice as long as broad); pronotum and elytra continuous in outline; shining, usually brightly maculate. Head broadest at posterior edge of eye. Front and back margin of eye very shallowly emarginate. A series of coarser punctures by anterior medial edge of eye. Clypeus not thickened; labrum distinctly emarginate, emargination with dense golden cilia. Maxilla four segmented; ultimate segment apically emarginate and approximately equal in length to basal three segments. Labial palpus four segmented; ultimate segment about equal to the combined lengths of second and third segments. Ligula roughly triangular, with a row of short spines along the anterior edge; mentum strongly lobed anteriorly on each side, produced between the labial palps. Antennae usually filiform (median segments expanded in *diversicornis*).

Pronotum broadest at base; basal width a little more than two times the midlength. Lateral bead distinct, approximately equal to width of second antennal segment. Posterolateral pronotal stria not present. Anterolateral corners of pronotum produced, bluntly pointed, posterolateral angles sharp. Prosternum distinctly declivitous (Figs. 41–45); declivity transversely ridged or rugose (Figs. 46, 47); anterior portion sometimes with dense stiff setae. Prosternal process lanceolate; strongly margined laterally; with definite medial ridge; bluntly pointed, apex extending between mesocoxae and touching metasternum.

Elytra widest in basal third or at middle, gradually tapered posteriorly; occasionally basal margins subparallel. In lateral view side margin straight, not ascending at base. Epipleura gradually narrowing, but more strongly, evenly constricted at level of second sternite.

Metasternum sulcate, shallowly in some species. Anterior and posterior edges of metacoxal plates subparallel. Metacoxal lines extending anteriorly to metasternum as thin carinate lines; lines a little divergent anteriorly. Metacoxal process laterally produced, covering base of hind trochanters; medially produced and sinuate on each side, apex recessed.

Metafemora shining, with definite medial line of setatious punctures. Anterior protarsi of male broadened; anterior protarsal claws modified. Usually more strongly bent basally and more sinuate on the inner edge than the posterior claw.

Genitalia symmetrical with parameres broadest at base; tapered posteriorly; aedeagus always deeply bifid.

Type-species.—*Hydroporus wickhami* Zaitzev (= *H. concinnus* LeConte) (Guignot, 1942).

Distribution.—The subgenus, as now defined, is restricted to North America, with most species found east of 97 degrees west longitude.

Taxonomic notes.—There are many species of *Hydroporus* in addition to the members of *Heterosternuta* which are found at the margins of streams; however, none has the aedeagus split dorsoventrally. In our experience species most frequently collected at stream margins and easily confused with the *Heterosternuta* are *H. stratiopunctatus*, *H. vitiosus* and *H. blanchardi*. Dark specimens of *H. blanchardi* are easily confused with the dark forms of *H. oppositus* but may be distinguished by the absence of prosternal bristles. *H. vitiosus* was originally grouped with the *pulcher-wickhami* group by Fall (1923) but Leech (1949) pointed out the aedeagus is not bifid and *vitiosus* is not a member of this group. *H. vitiosus* may be separated from the *Heterosternuta* on the basis of external characters by the combination of the dark ventral surface and the lack of modified prosternal setae. *H. stratiopunctatus* may be easily separated from all other species by the alternating of deeply impressed elytral punctures and rather fine punctures.

Diagnostic characters.—A brief consolidated overview of diagnostic characters is presented to facilitate use of the key, especially for the non-taxonomic specialist.

Coloration.—The color of the head ranges from yellowish to orangish. Head color differences have only been used to help separate *ohionis* Fall (orangish) from *jenniferae* Wolfe and Matta (yellowish).

The most common pronotal color pattern in *Heterosternuta* consists of an anterior infuscation (usually evenly extended along the entire anterior edge) and a separate, more restricted and variable posterior infuscation. The anterior infuscation is somewhat reduced in *cocheconis* Fall and *diversicornis* Sharp and most reduced in *ouachitus* Matta and Wolfe. In three species (*jeanneae* Wolf and Matta, *sulphurius* Matta and Wolfe and *laetus* Leech) the pronotum is uniformly reddish-brown.

Elytral coloration may only be used to conclusively identify one species, *jeanneae*. In that species there is a large dark sub-medial elytral fascia (Fig. 8). Most other species possess two dark and three light fascia; however, interconnections between dark fascia sometimes obscure the distinctly fasciate appearance (*e.g.* compare Figs. 17–19).

Metasterna, metacoxa and abdominal sterna are usually orangish or yellowish. However, in *oppositus* and *wickhami* ventral coloration tends to be dark blackish-red with medial portions of metacoxae and abdominal sterna usually reddish. The degree of infuscation is more pronounced in *wickhami* than *oppositus*.

Microsculpture.—The reticulation pattern is very conservative, usually appearing as a pentagonal mesh. However, punctation can be a valuable supplement in identification. In *Heterosternuta*, elytral and metacoxal punctures vary from fine and dense (Figs. 48, 61 *pulcher*) to very coarse and sparse (Figs. 59, 70 *folkertsi*). The differences between some species are

subtle while differences between others are so extreme that knowledge of that difference can completely eliminate confusion. For example, the metacoxal punctation of *pulcher* is so fine it should not be confused with coarsely punctate species like *cocheconis*, *folkertsi*, or *ouachitus* (Figs. 52, 59, 50). Differences in elytral punctation are usually similarly useful.

Head.—There are few morphological head characters important in species identification. The clypeus is not thickened and there is a series of coarse punctures at the anterior corner of each eye in all *Heterosternuta*. Antennae are always filiform; however, the broadened medial antennal segments (5 through 8, segment 6 twice as broad as 11) of male *H. diversicornis* (Fig. 25) affords ready identification of that species.

Pronotum.—Pronotal morphology and shape is not generally useful. The pronotal margin is distinctive in *H. oppositus* specimens from the southern portion of its range (southern Virginia and Tennessee), because it is subtly sinuate anteriorlaterally.

Prosternum.—The prosternum is always angularly declivitous (Figs. 42–45). The declivity is less pronounced in some species but this variation is too subtle to be useful.

The declivitous portion of the prosternum is ridged (Figs. 46, 47). In most species the ridges are irregular (rugose) (Fig. 46) but in four species (*wickhami*, *oppositus*, *diversicornis*, and *jeanneae*) the ridges are transverse and regularly placed (Fig. 47). The characters associated with the declivitous area are consistent but minute.

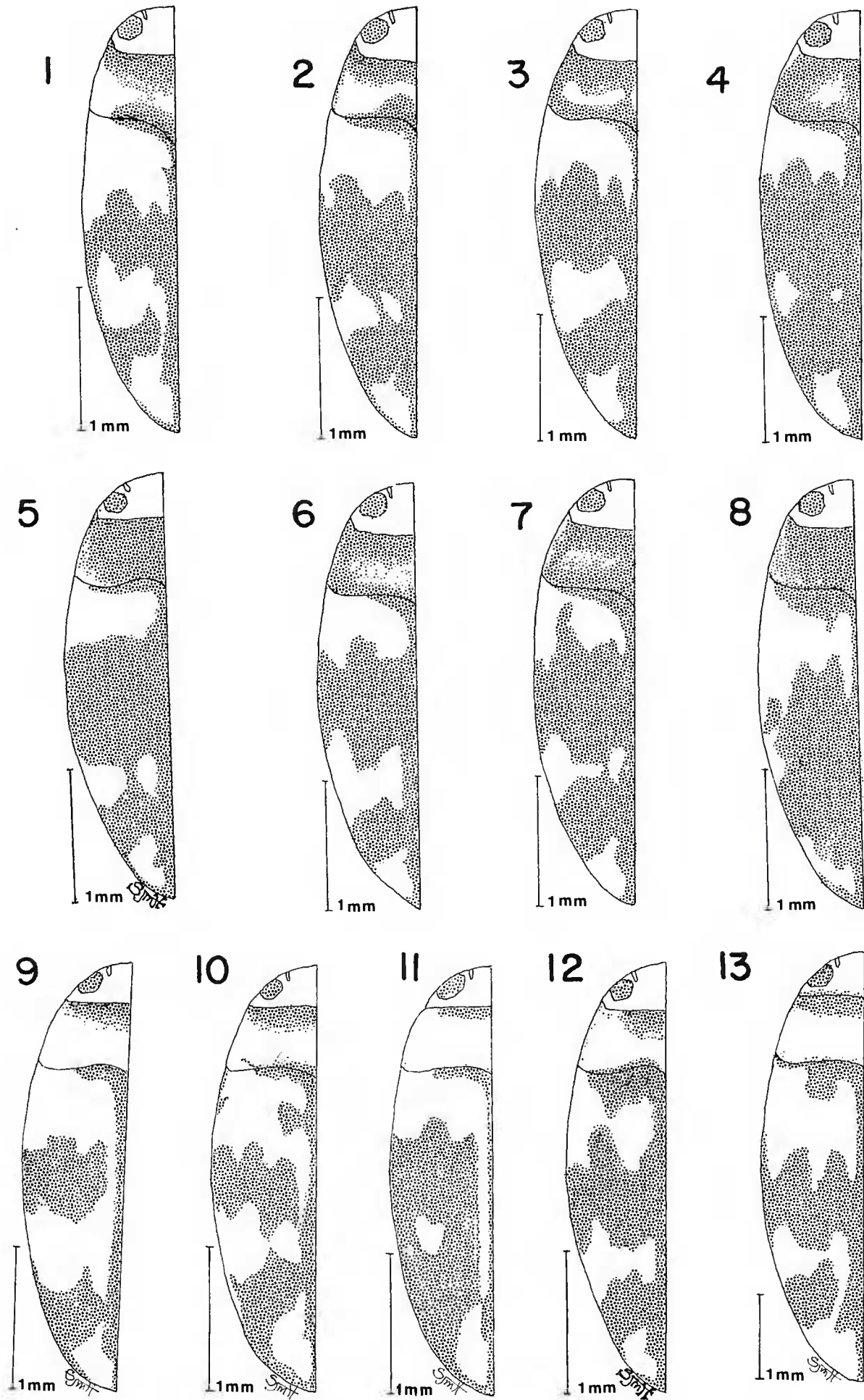
The most useful, readily observable prosternal character involves the degree of modification of setae on the base of the prosternum, just anterior to the procoxae. In some species prosternal setae are sparse and slender (Fig. 42); in other species prosternal setae are elongate, stiff and thickened (Figs. 43–45). Modified setae are present in *diversicornis*, *jeanneae*, *wickhami*, *oppositus*, *jenniferae* and *ohionis*; however, the modified setae are less developed in the last two species.

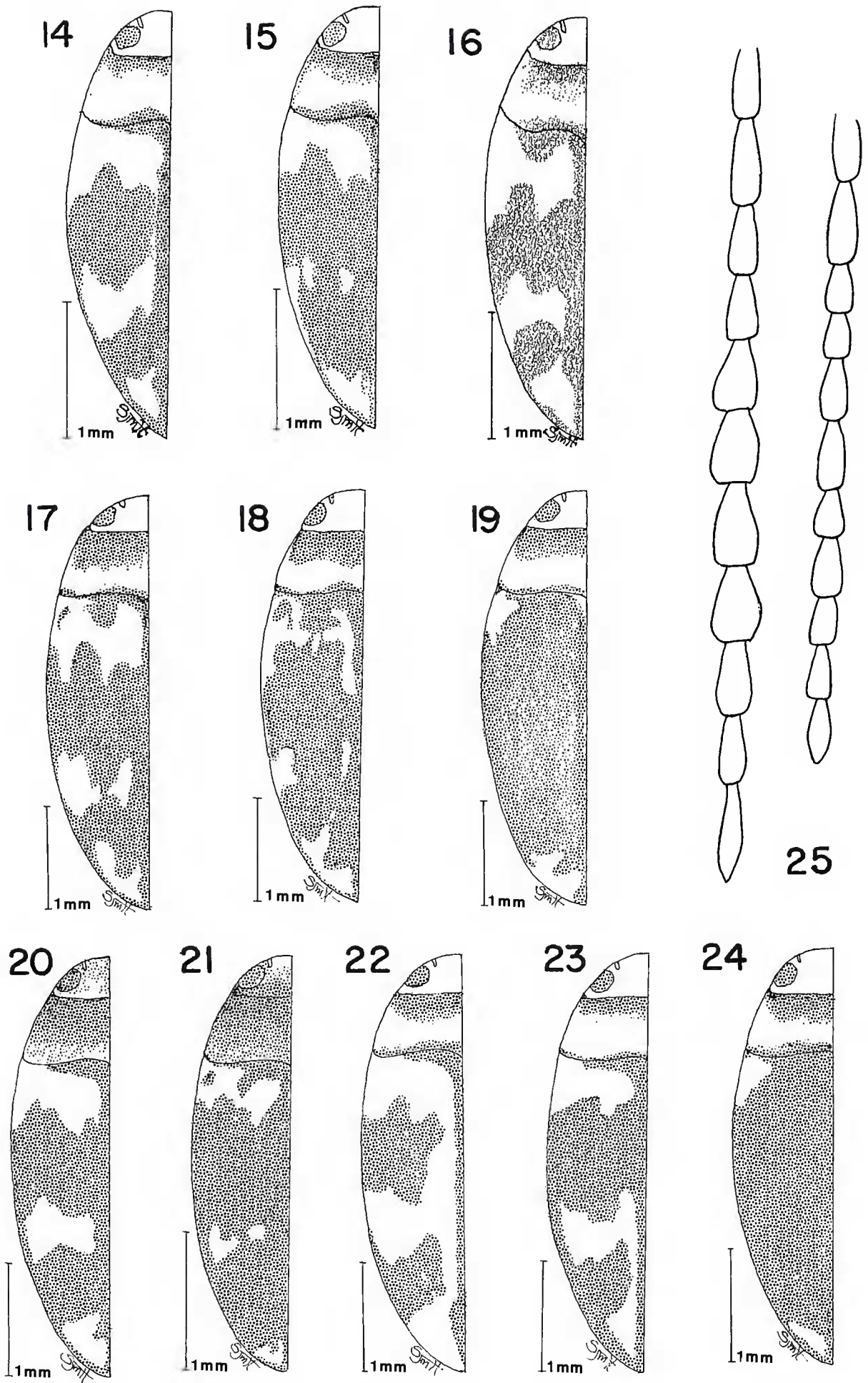
Elytra.—In a few species (*ouachitus*, *allegghanianus* Matta and Wolfe and *cocheconis*) the basal, lateral, outer edge of each elytron is very slightly concave for about $\frac{1}{3}$ its length.

Metacoxae.—Metacoxal characters are not of use in most species; however, there is a distinct pubescence (Figs. 40–41) restricted to the internal lamina on one species, *diversicornis*.

→

Figs. 1–13. Figs. 1, 2. *H. folkertsi*, Jefferson Co., AL. Figs. 3, 4. *H. jenniferae*, Trousdale Co., TN. 5. *H. sulphurius*, Benton Co., AR. Fig. 6. *H. ohionis*, Clarke Co., KY. Fig. 7. *H. ohionis*, Dearborne Co., IN. Fig. 8. *H. jeanneae*, Trousdale Co., TN. Fig. 9. *H. allegghanianus*, Morgan Co., TN. Figs. 10, 11. *H. allegghanianus*, Stewart Co., TN. Fig. 12. *H. ouachitus*, Polk Co., AR. Fig. 13. *H. diversicornis*, Blanco Co., TX.





Legs.—Leg morphology is very uniform and not of use in species identification. Secondary sexual characteristics of the protarsus and protarsal claw are discussed below.

Genitalia.—The aedeagus apex is always deeply bifid and this is especially evident in ventral view (Figs. 26–38). In some species there is a distinct subapical ventral projection evident in lateral view (Figs. 30–33, 35); in other species this projection is reduced and appears more as an angular prominence (Figs. 34, 36–38). The subapical ventral projection is absent in four species (Figs. 26–29).

The dorsal aedeagal surface is completely membranous only in *oppositus* and *wickhami*. In all other species at least a portion of the dorsal surface is sclerotized. In most species there is a small sclerotized cross bridge in the posterior dorsal portion of the aedeagus (Figs. 28, 30–37) but in *diversicornis* the entire dorsal surface is sclerotized (Fig. 29).

Length.—Total length is so variable that it is only helpful in separating the smallest species, *alleghenianus*, from other *Heterosternuta*.

Secondary sexual characters.—In some species males are shinier than females. In most *Heterosternuta* the protarsi are broadened and the anterior protarsal claw is more strongly bent basally and at least vaguely sinuate on the inner side. Protarsal modifications are least pronounced in *folkertsi* and *cocheconis* and most pronounced in *jeanneae* (Fig. 39f) and some *oppositus* (from southern Virginia and Tennessee).

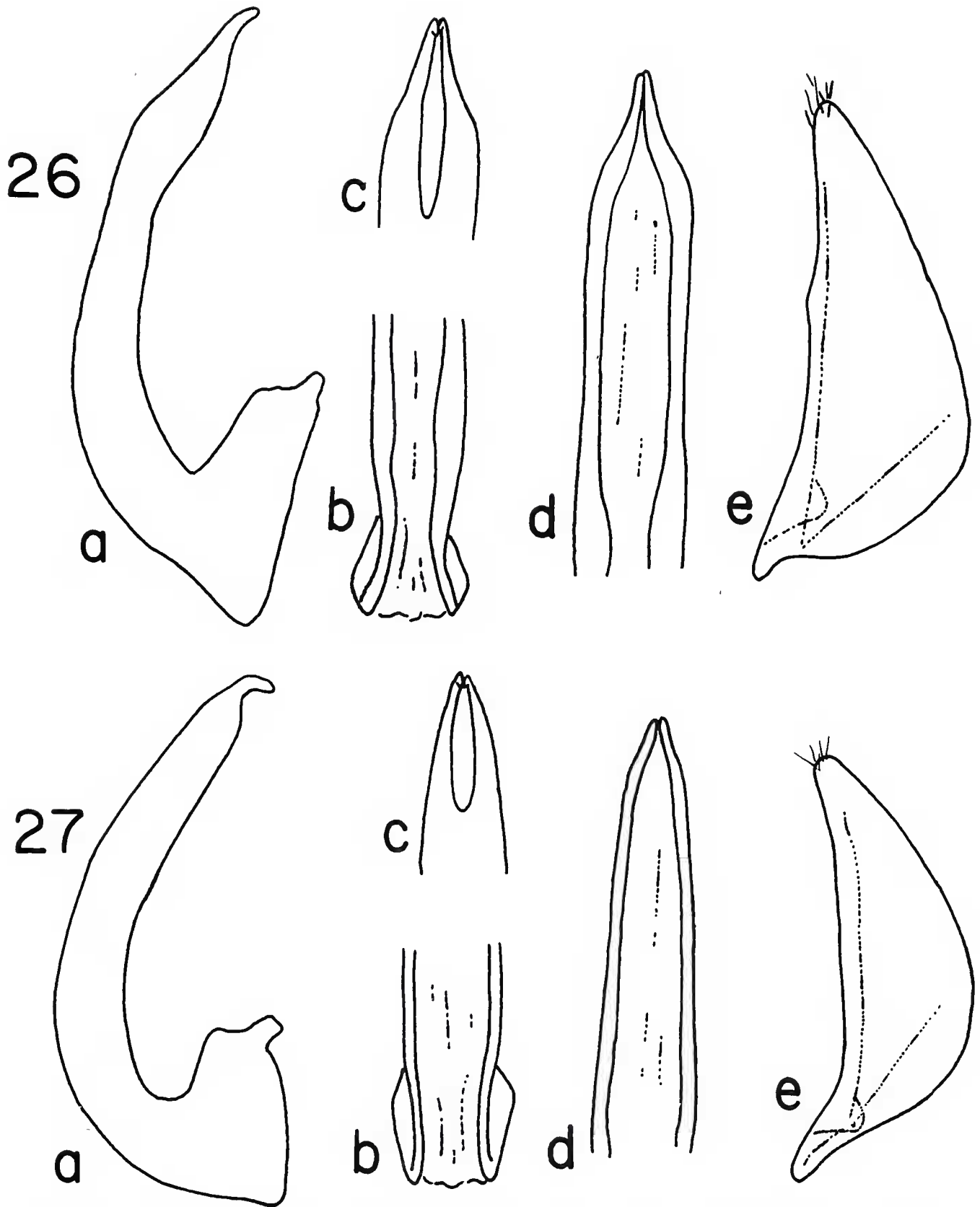
The modified antennal segments in *diversicornis* were discussed above. Additionally, the pubescence of the metacoxae of *diversicornis* is denser in males (Fig. 40) than in females (Fig. 41).

A Key to the Species of Subgenus *Heterosternuta* Strand

- 1. Prosternum with dense tufts of thickened setae anterior to the coxae (Figs. 43–44) 2
- Without modified prosternal setae (Fig. 42) 7
- 2. With the area between the coxal lines densely pubescent (Figs. 40–41); male with middle antennal segments (5–8) broadened and flattened, 6th segment twice as broad as 11th) (Fig. 24) *diversicornis*

←

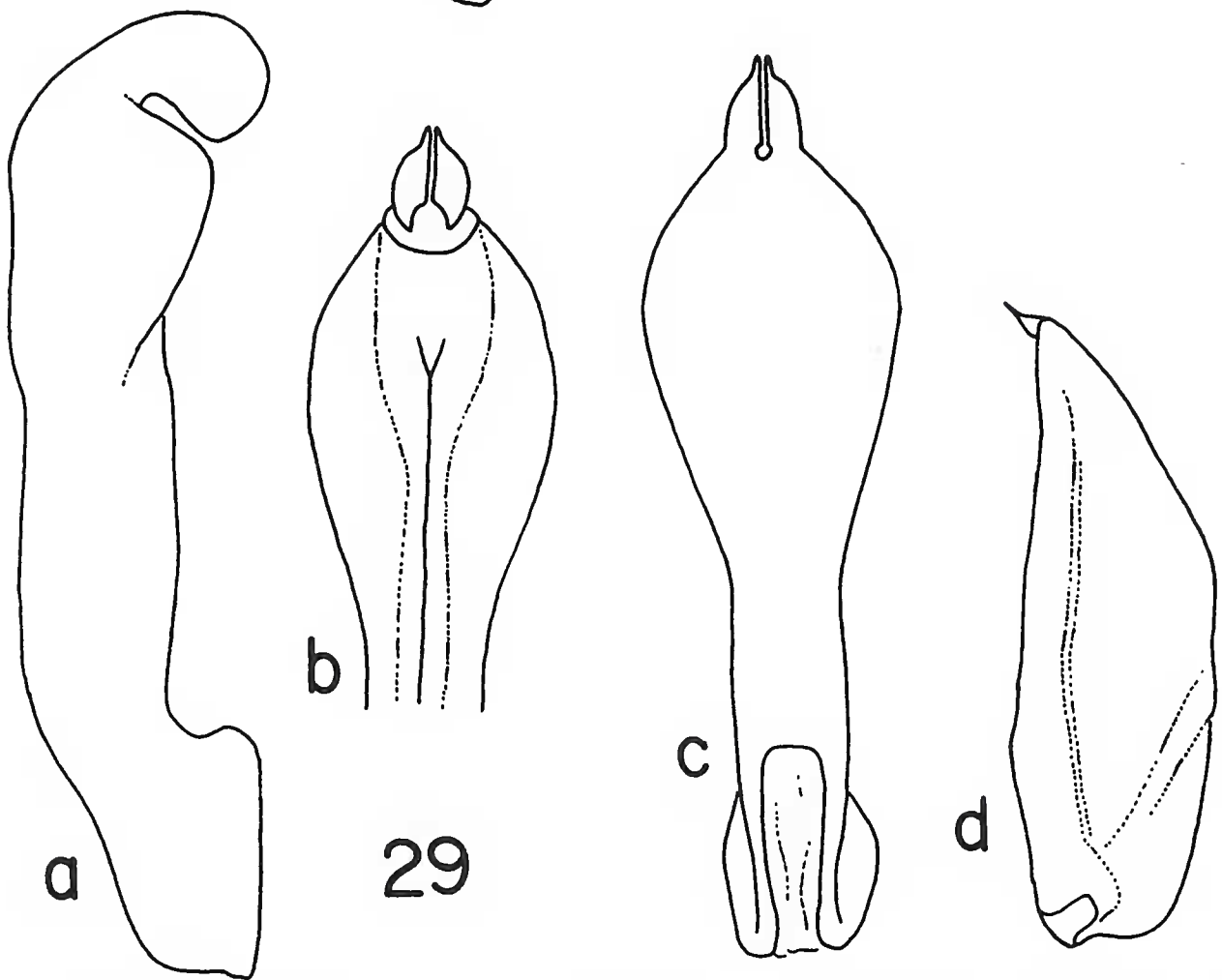
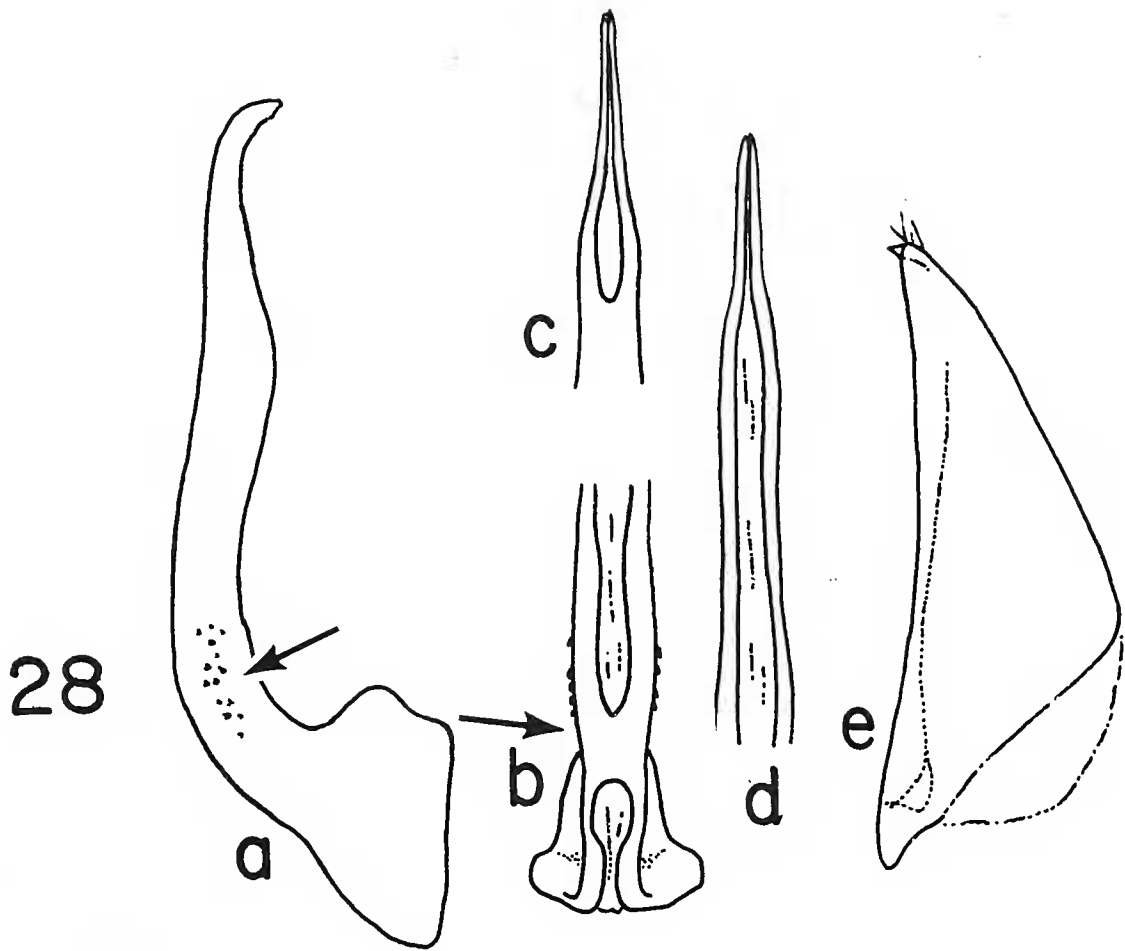
Figs. 14–25. Fig. 14. *H. cocheconis*, Cambria Co., TN. Fig. 15. *H. cocheconis*, Tolland Co., CT. Fig. 16. *H. wickhami*, Bledsoe Co., TN. Fig. 17. *H. oppositus* Grundy Co., TN. Fig. 18. *H. oppositus*, Frederick Co., VA. Fig. 19. *H. oppositus*, Benton Co., VT. Fig. 20. *H. laetus*, Trimble Co., KY; Fig. 21. *H. laetus*, Macon Co., TN; Fig. 22. *H. pulcher*, Ross Co., OH. Fig. 23. *H. pulcher*, DeKalb Co., TN. Fig. 24. *H. pulcher*, E. Varick, NY. Fig. 25. *H. diversicornis*, antennae (male right, female left).



Figs. 26, 27. Fig. 26. *H. oppositus*. Fig. 27. *H. wickhami*. a, aedeagus, lateral view; b, posterodorsal view (note absence of sclerotized cross bridge, see Fig. 28); c, ventral apex; d, dorsal view; e, paramere, lateral view.

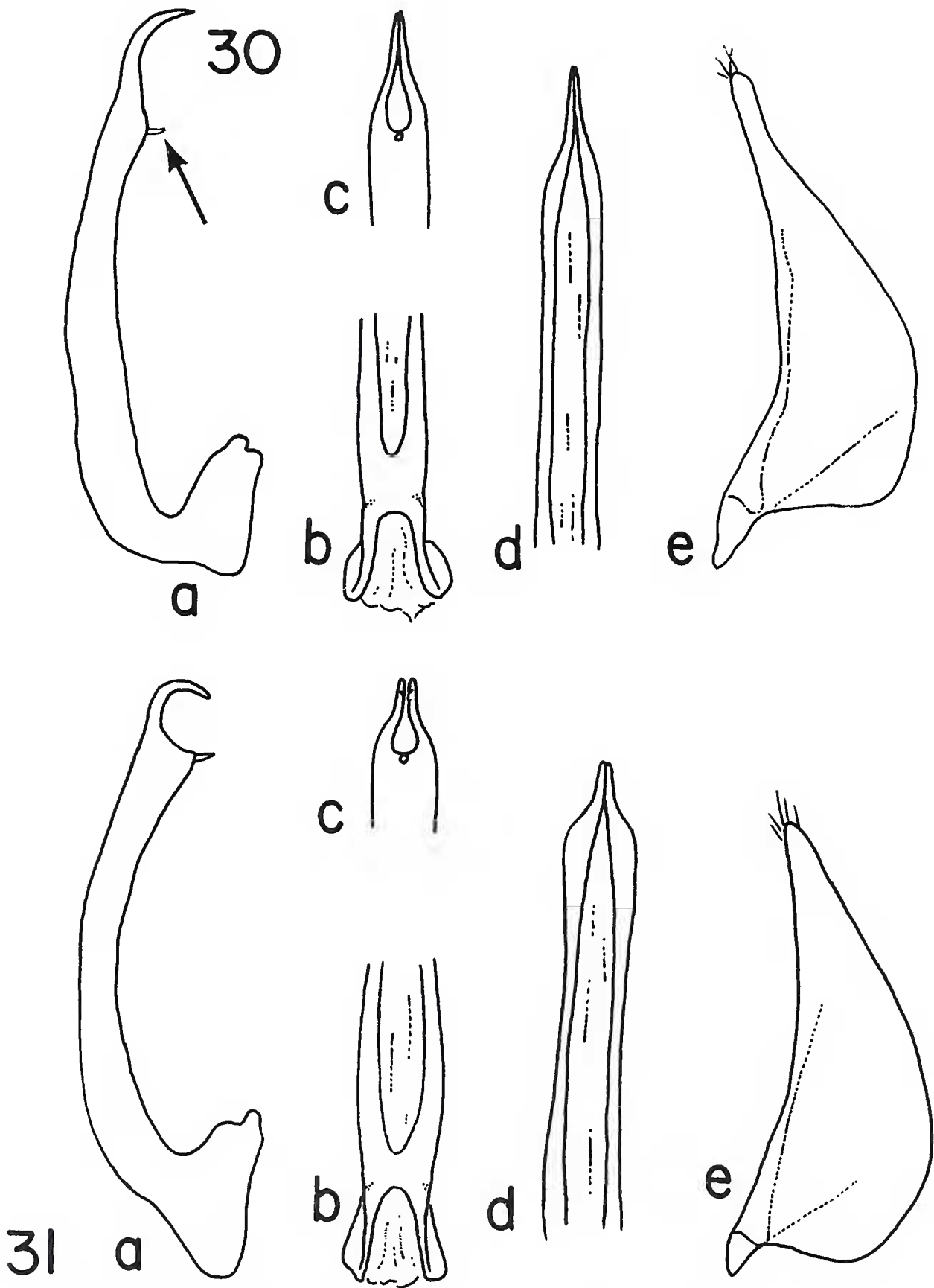
→

Figs. 28–29. Fig. 28. *H. jeanneae*; a, lateral view of aedeagus (arrow indicates postero-lateral pustules); b, posterodorsal view (arrow indicates sclerotized cross bridge); c, ventral apical view of aedeagus; d, dorsal view of aedeagus; e, paramere, lateral view. Fig. 29. *H.*

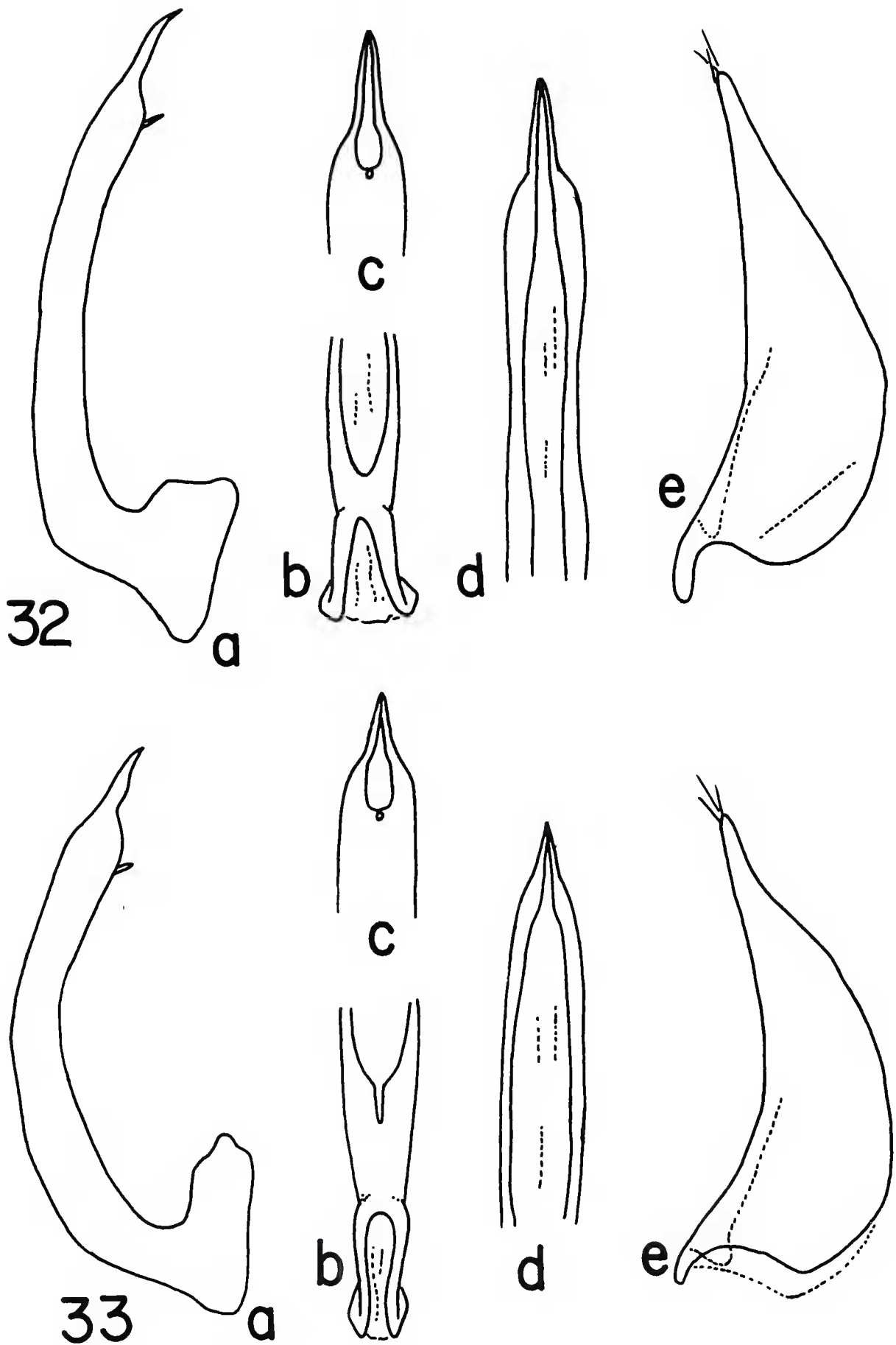


diversicornis; a, aedeagus, lateral view; b, aedeagus, ventral apical view; c, aedeagus, dorsal view; d, paramere, lateral view.

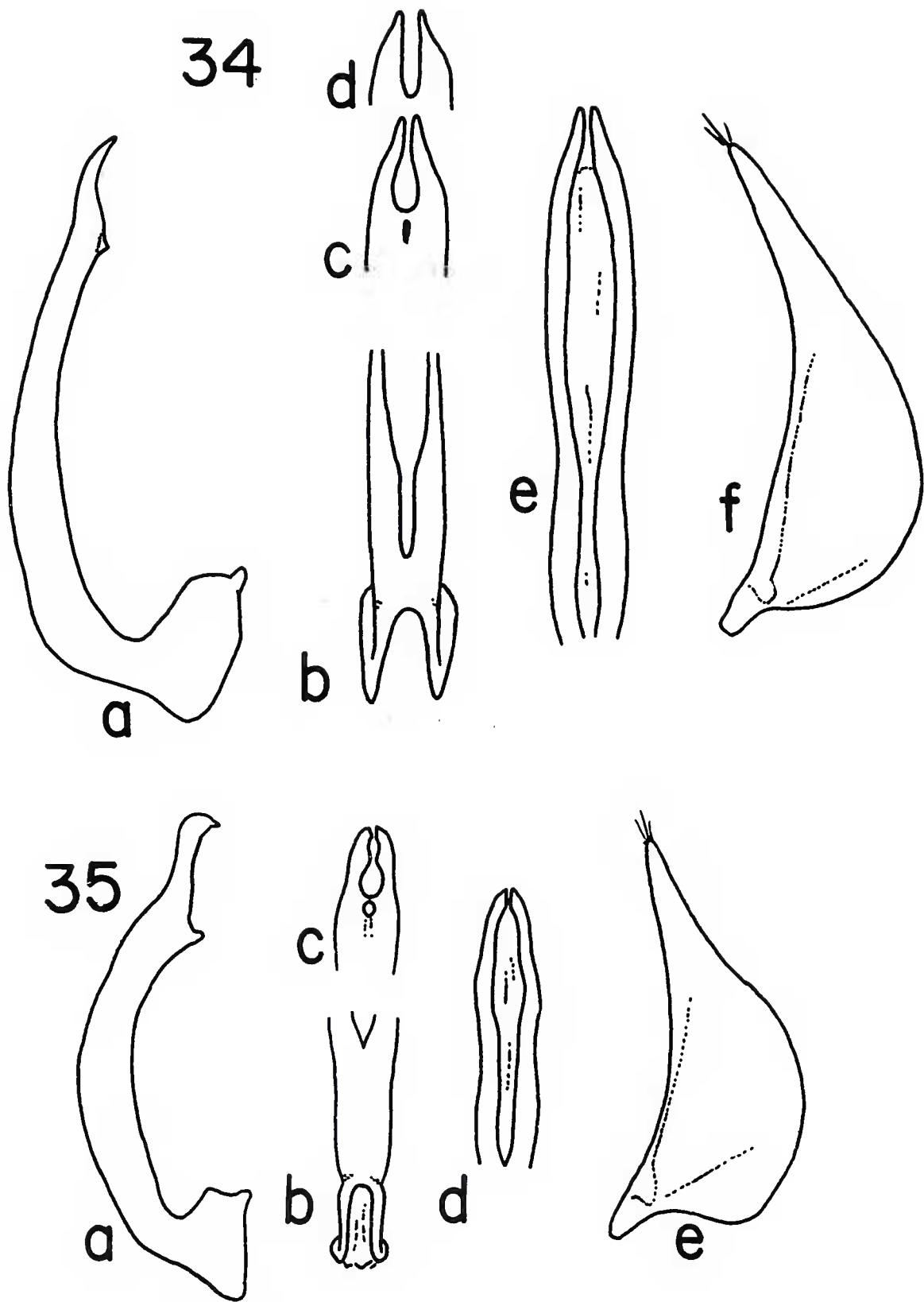
- The area between the coxal lines not pubescent; male with middle antennal segments (5–8) not broadened (6th segment equal or slightly wider than 11th) 3
3. Pronotum uniformly reddish-brown; elytron with a pale basal fascia and a long posterior dark brown fascia (Fig. 8). Aedeagus posterolaterally with minute denticles (Fig. 28a); apex elongate, gently tapering *jeanneae*
 Pronotum with some pale fascia; elytron not as above, usually with 2 dark and 3 light fascia 4
4. Aedeagus with a posterior sclerotized bridge (Fig. 28b); metacoxal punctation coarse (Figs. 57–58); ventral surface yellowish or orangish 5
 Aedeagus without a posterior sclerotized bridge (Figs. 26–27); metacoxal punctation finer (Figs. 54–55); usually with extensive darkening of the ventral surface, at least laterally 6
5. Length 3.3 mm or less; head more orangish or reddish; aedeagus as in Fig. 32 *ohionis*
 Length usually greater than 3.3 mm; head rather yellowish; aedeagus as in Fig. 31 *jenniferae*
6. Ventrally more blackish, elytral (Fig. 62) and metacoxal (Fig. 54) punctation just perceptibly finer. Best separated from *oppositus* by the shape of the aedeagus (Fig. 27a) which is more distinctly deflected ventrally at the apex *wickhami*
 Ventral surface reddish, at least medially; elytral (Fig. 63) and metacoxal (Fig. 55) punctation a little coarser; aedeagus (Fig. 26a) more elongate, not as distinctly deflected at apex .. *oppositus*
7. Length less than 3.1 mm, usually less than 3.0 mm; aedeagus with a distinct ventral projection (Fig. 30a) *alleghenianus*
 Length usually greater than 3.1 mm, if less than 3.1 mm and aedeagus with a ventral projection then pronotum completely infuscate 8
8. Pronotum uniformly reddish brown (Figs. 5, 20–21) or with yellow markings reduced to very small spots 9
 Pronotum with transverse anterior and posterior infuscation, disc yellow (Figs. 9–13) 10
9. Aedeagus apex extremely acute in dorsal view, with a distinct ventral projection (Fig. 30) *sulphurius*
 Aedeagus apex not very acute in dorsal view, without a ventral projection (Fig. 36) *laetus*
10. Metacoxal punctation very distinctly fine and dense (Fig. 48); aedeagus broadly flattened at apex (Fig. 38) *pulcher*
 Metacoxa more coarsely punctate (Figs. 50, 52, 59), not appearing smooth 11



Figs. 30, 31. Fig. 30. *H. sulphurius*. Fig. 31. *H. jenniferae*. a, aedeagus, lateral view (arrow indicates ventral subapical prong); b, aedeagus, posterodorsal view; c, aedeagus, ventral apical view; d, aedeagus, dorsal view; e, paramere, lateral view.



Figs. 32, 33. Fig. 32. *H. ohionis*. Fig. 33. *H. folkertsi*. a, aedeagus, lateral view; b, aedeagus, posterodorsal view; c, aedeagus, ventral apical view; d, aedeagus, dorsal view; e, paramere, lateral view.



Figs. 34-35. Fig. 34. *H. cocheconis*; a, aedeagus, lateral; b, aedeagus, posterodorsal; c, d, aedeagus, ventral apical (bifurcate tips showing variation); e, aedeagus, dorsal; f, paramere, lateral. Fig. 35. *H. alleghenianus*; a, aedeagus, lateral (arrow indicates ventral subapical prong); b, aedeagus, posterodorsal; c, aedeagus, ventral apical; d, aedeagus, dorsal; e, paramere, lateral.

11. Aedeagus as in Fig. 34; size variable but usually greater than 3.3 mm; northeastern U.S. and Canada *cocheconis*
 Aedeagus not as above; size usually less than 3.3 mm; not in northeastern U.S. 12
12. Aedeagus as in Fig. 33; presently known from Alabama *folkertsi*
 Aedeagus as in Fig. 37; presently known from the Ozark province *ouachitus*

Hydroporus alleghenianus Matta and Wolfe

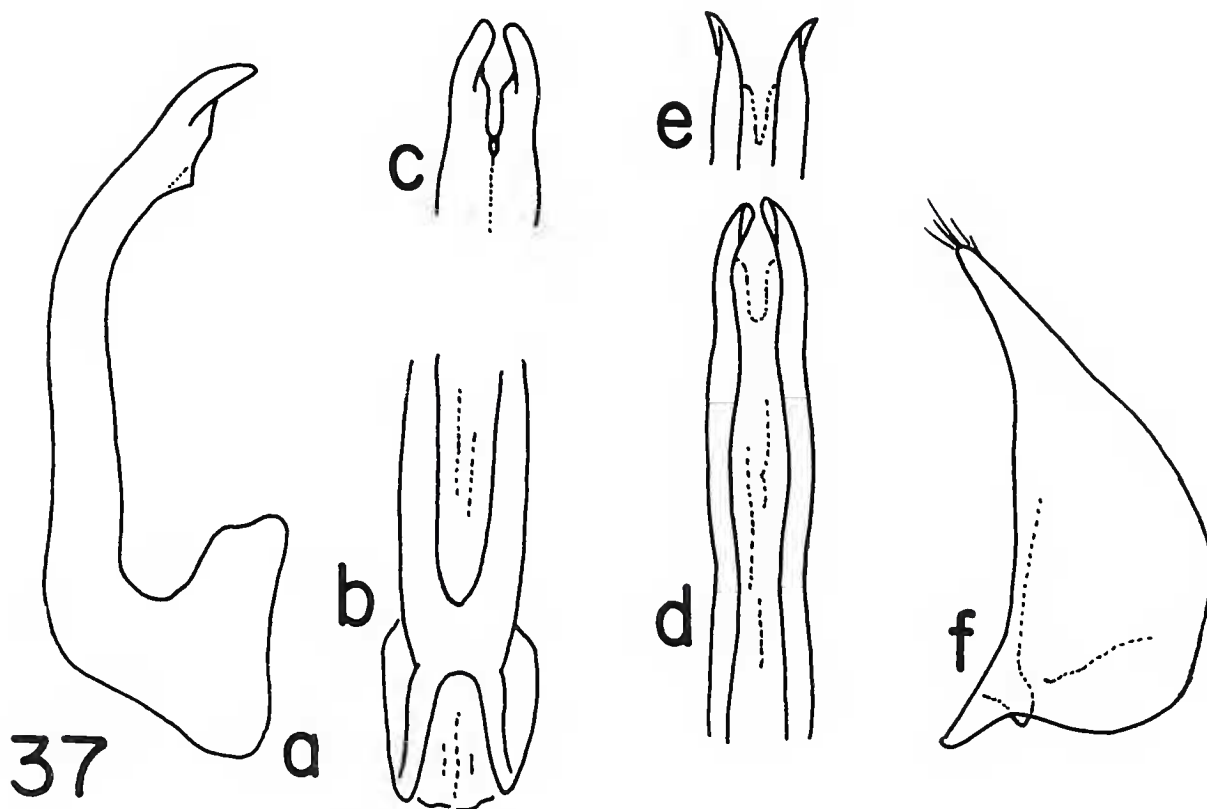
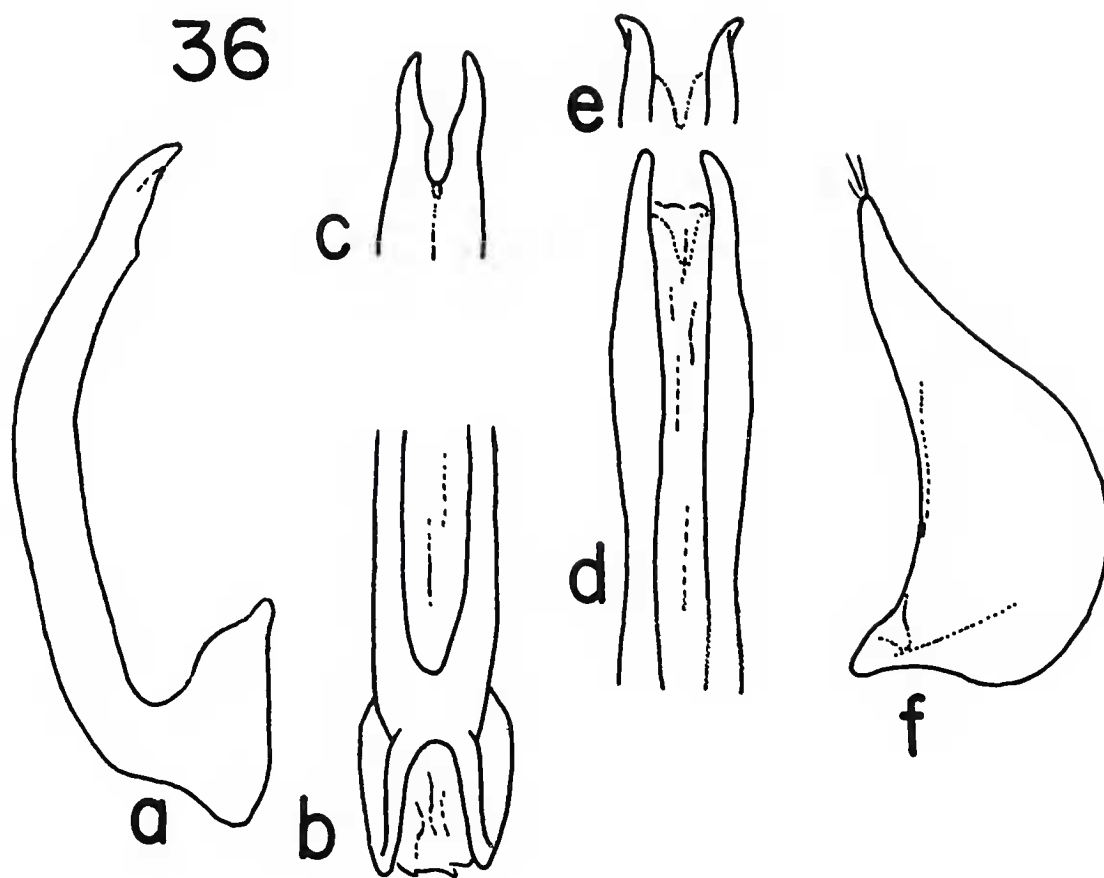
Hydroporus alleghenianus Matta and Wolfe 1979:291.

This is the smallest species in the *pulcher* group with an average size of less than 3 mm. Small specimens of several species approach this size, but may always be separated on the basis of the male genitalia. The species is quite uniform in size throughout its range; however, some specimens from the western portions of its range have the medial and apical fascia broadly coalesced.

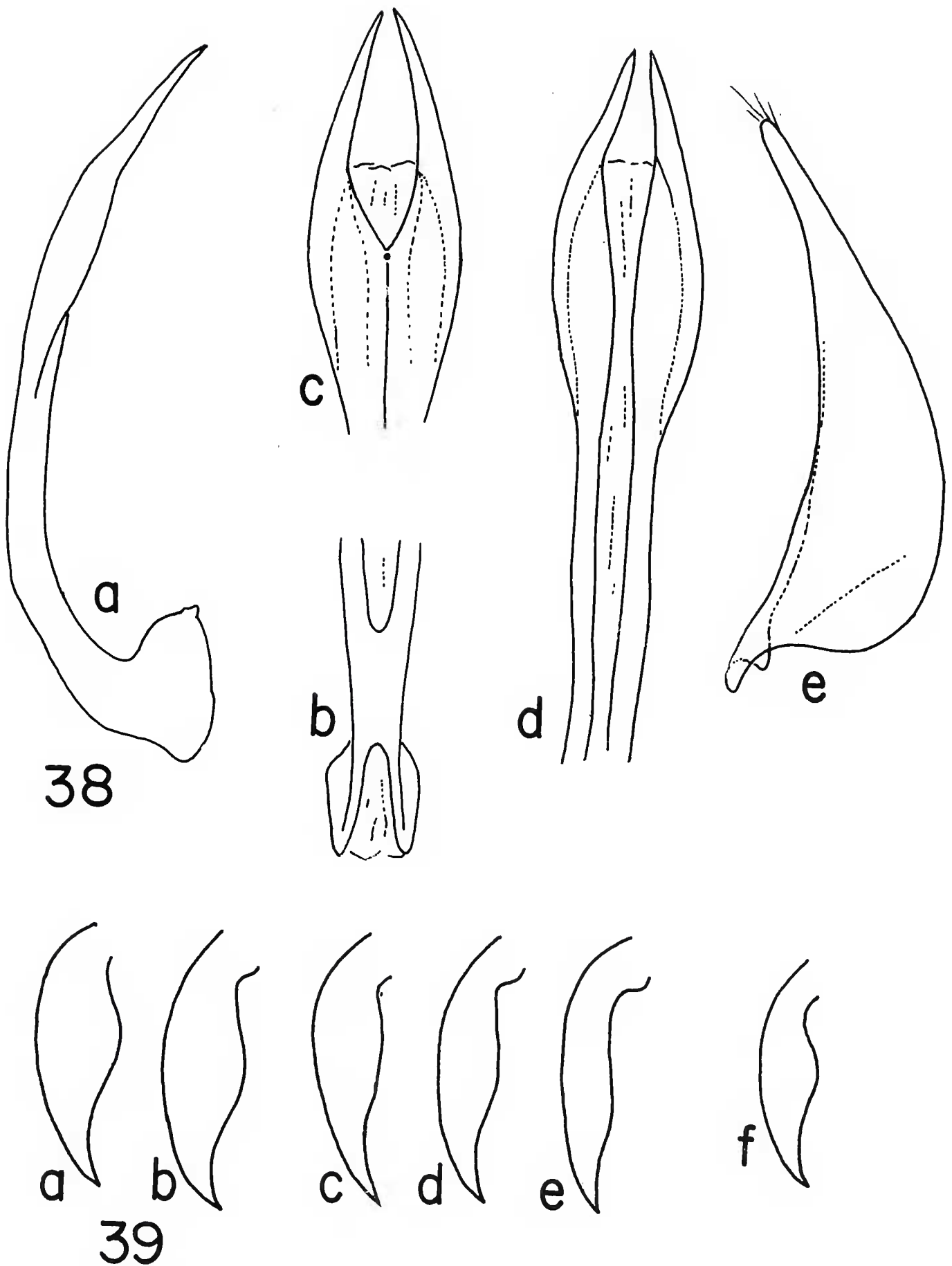
Description.—Length 2.6 to 3.1 mm; width 1.2 to 1.5 mm. Form elongate oval, sides of elytra subparallel, widest at middle, elytra and pronotum almost continuous in outline, however basal lateral elytral edges very slightly concave. Lateral margins of pronotum evenly rounded inward toward the anterior angles, lateral bead distinct, gradually broader anteriorly, at maximum width a little less than the width of the second antennal segment. Prosternal prominence angular, not protuberant, file area rugose, prosternal process lanceolate, bluntly pointed, modified prosternal setae absent.

Rather shining dorsally, a little alutaceous. Head pale yellow; pronotum with broad blackish band along anterior margin, basal infuscation very narrow, sometimes scarcely evident, discal and lateral areas pale yellow. Elytra with yellow and brownish-black fascia (Figs. 9–11). Sutural stripe usually distinct and extending narrowly laterally up to one half the basal width. Medial fascia broad, undulating, sometimes isolated from the sutural stripe; basal and medial fascia not connected. Apical fascia smaller, also occasionally isolated from the sutural stripe, apical and medial fascia usually separate; however, some specimens have broadly coalesced apical and medial fascia, usually isolated from the sutural stripe.

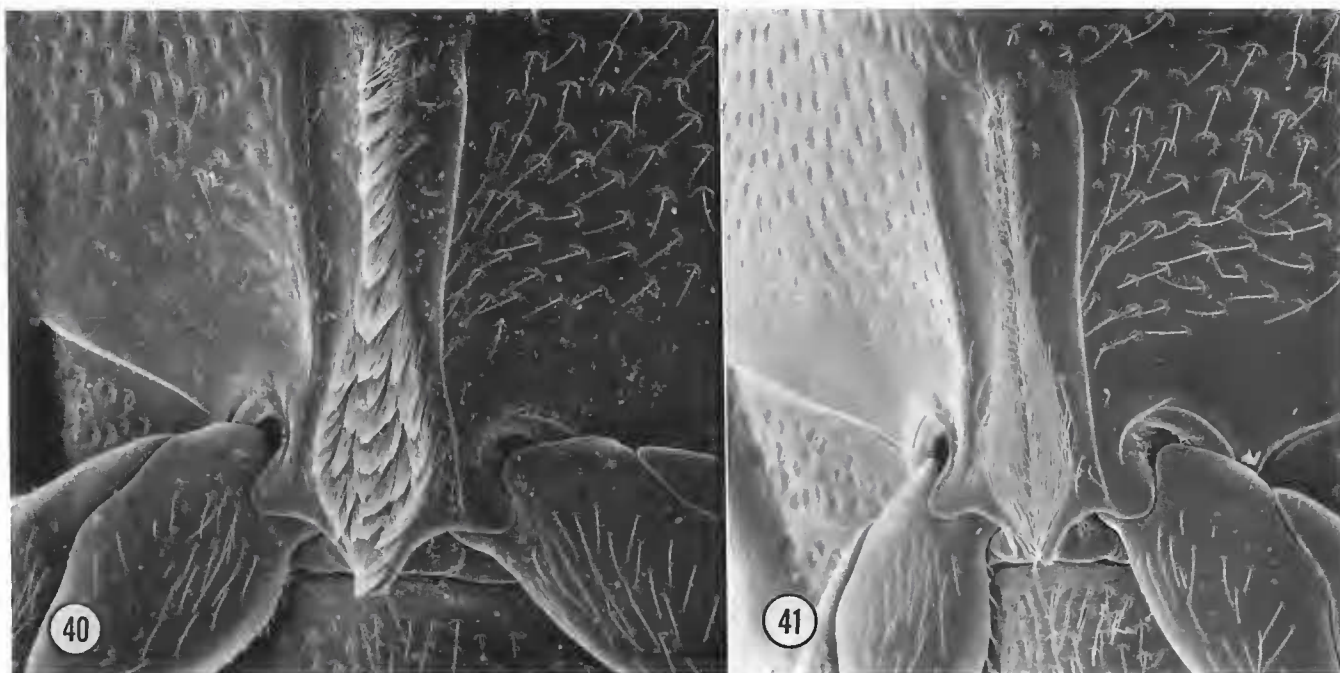
Dorsal surface with evident microreticulation. Head randomly, finely punctate, punctures usually separated by 1 to 3 times puncture width; finer anteriorly, densest in shallow depressions. Pronotal punctures a little coarser, usually separated by 1 to 2 times puncture width, somewhat denser paralleling the anterior margin. Elytral punctation fine, somewhat sparse, punctures separated by about 2 puncture widths (Fig. 65). Ventrally metacoxal punctures coarse, somewhat sparse (Fig. 49). Metasternal punctures



Figs. 36, 37. Fig. 36. *H. laetus*. Fig. 37. *H. ouachitus*. a, aedeagus, lateral; b, aedeagus, posterodorsal; c, aedeagus, ventral apical; d, aedeagus, dorsal (wet); e, aedeagus, dorsal apex (dry); f, paramere, lateral.



Figs. 38–39. Fig. 38. *H. pulcher*; a, aedeagus, lateral view; b, aedeagus, posterodorsal; c, aedeagus, ventral apical; d, aedeagus, dorsal; e, paramere, lateral. Fig. 39. a–e, *H. oppositus*; anterior protarsal claw of male; a, Grundy Co., TN; b, Grainger Co., TN; c, Frederick Co., VA; d, Belfrage, PA; e, Benton Co., VT; f, *H. jeanneae*, Trousdale Co., TN.



Figs. 40, 41. *H. diversicornis* metacoxae (96 \times). Fig. 40. Male; Fig. 41. Female.

a little coarser, finer medially. Abdominal sternum 1 and anterior half on sternum 2 coarser, rest of abdomen finer.

Male protarsi and anterior protarsal claw scarcely modified. Aedeagus with subapical ventral projection peg-like (Fig. 34).

Females are similar to males. No external sexual characters are evident. *Larvae*.—Unknown.

Type data.—The holotype and allotype are from Bath Co., VA, collected by J. F. Matta on VIII-9-73. They are deposited in the collection of J. F. Matta but have NMNH type number 75967.

Range.—Indiana, Ohio, Illinois, Virginia, Kentucky, North Carolina, Tennessee (Fig. 74).

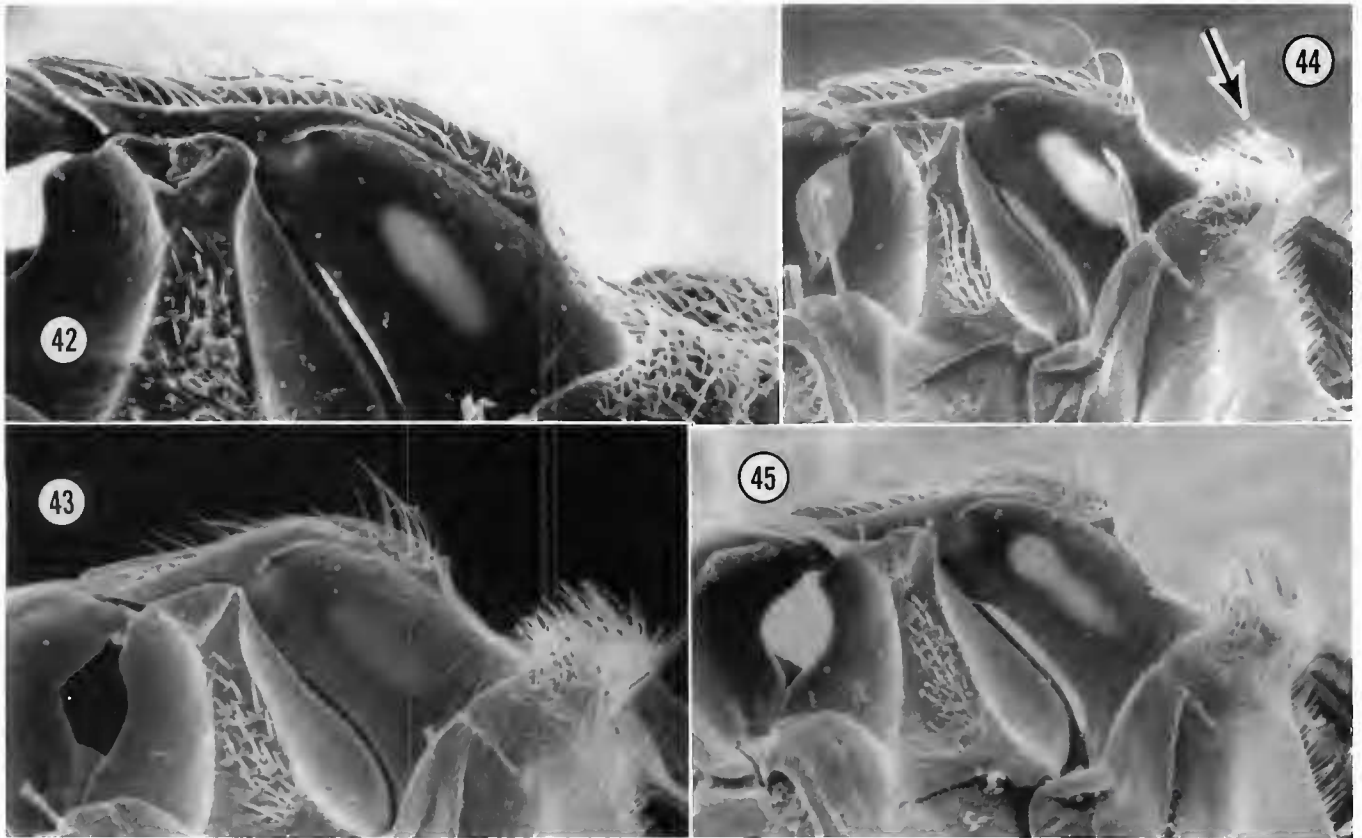
Natural history.—Teneral specimens were collected in August. This species is found in marginal pools of streams with pebble substrate and leaf litter. Large collections have been obtained from very small (possibly intermittent) streams. While some specimens have been collected from the stream itself most were found in small coves or isolated pockets of water less than 0.5 meters wide.

Hydroporus cocheconis Fall

Hydroporus cocheconis Fall 1917:171.

This species may be separated from other *Heterosternuta* by the absence of prosternal setae, the coarse punctation of the ventral surface (Fig. 52) and the distribution (northeastern U.S. and Canada).

Description.—Length 3.0 to 3.7 mm; width 1.4 to 1.8 mm. Form elongate oval, widest at middle; elytra almost parallel sided for the basal half, very



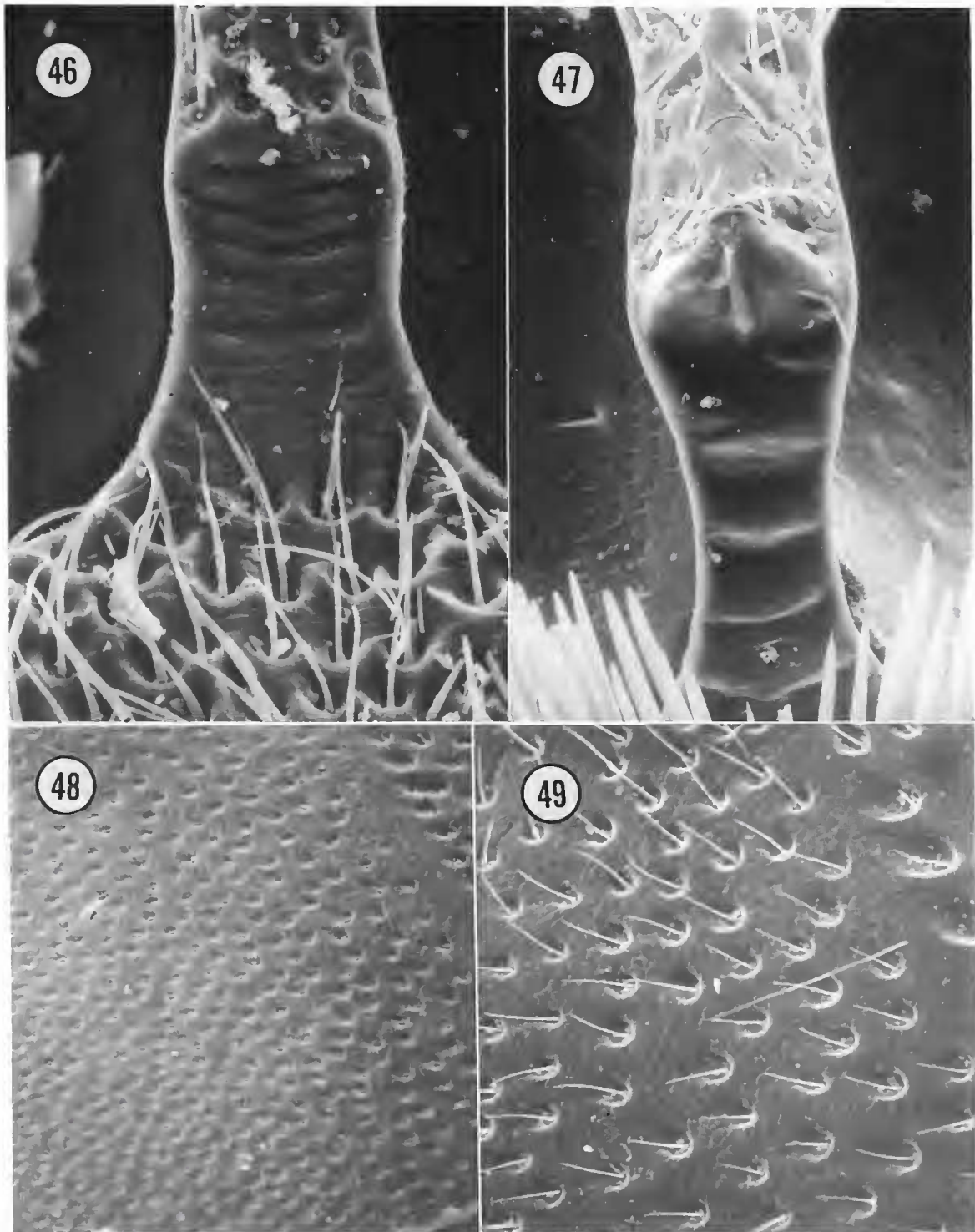
Figs. 42–45. Prosternum and prosteral process, legs and head removed. Fig. 42. *H. pulcher* (180×). Fig. 43. *H. ohionis* (114×). Fig. 44. *H. jenniferae* (123×) (arrow points to prosteral bristles). Fig. 45. *H. wickhami* (132×).

slightly concave in basal third; edges of elytron and pronotum continuous in outline. Lateral margins of pronotum evenly rounded toward anterior angle and with well defined lateral bead which widens anteriorly; at widest point about the width of fourth antennal segment. Prosternal prominence angular but not distinctly protuberant, file not pronounced; modified prosternal setae absent; prosteral process broadly lanceolate, blunt at tip.

Strongly shining dorsally, head pale yellow with light brown mottling which is darkest posterior to eyes. Antennae brown with the last segment infusate. Pronotum with an even broad dark band on the anterior margin which does not extend to the side margins. Elytra (Figs. 14, 15) with sutural stripe distinct. Middle and apical spots narrowly connected to each other and broadly connected to the sutural stripe. Ventral surface yellow-brown, legs slightly darker.

Dorsal surface with reticulation fine and weak, especially on the elytra. Punctuation of head very fine; pronotal and elytral (Fig. 64) punctuation larger, punctures separated by as much as a puncture width (Fig. 64). Ventral punctuation coarser; metasternal and metacoxal punctures quite large and separated by less than $\frac{1}{2}$ a puncture width (Fig. 52). Abdominal sternum 1 and anterior portion of 2 coarsely punctate; rest of abdomen finely punctate.

Male protarsi slightly broader than female, with anterior protarsal claw



Figs. 46–49. Fig. 46. *H. ouachitus*, rugose prosteral declivity (400 \times). Fig. 47. *H. jeanneae*, transversely ridged prosteral declivity (384 \times). Fig. 48. *H. pulcher*, metacoxal punctation (150 \times). Fig. 49. *H. alleghenianus*, metacoxal punctation.

bent at base and slightly broadened on inner margin. Aedeagus and parameres as in Fig. 34.

Variation.—Specimens from Connecticut are smaller than average and are strongly marked with the darker markings appearing almost black.

Larvae.—Unknown.

Type data.—Fall (1917) never designated a holotype but stated that he had a series of specimens from the Coheco River at Farmington, New

Hampshire, which were taken in July and August. The type series is in the MCZ and there are 8 specimens collected in July and August 1900 and 1 specimen collected in August 1902.

One male bears a type label with the number 23919; however, the genitalia of this specimen are apparently lost. Since there has never been a published type designation we have designated another male specimen as the lectotype and all other syntypes as paralectotypes.

Range.—The northeast; Quebec, New Hampshire, Vermont, New York and Connecticut (Fig. 75).

Natural history.—This species is typically found at gravelly margins of smaller streams in areas protected from the current, or in overhanging vegetation.

Hydroporus diversicornis Sharp

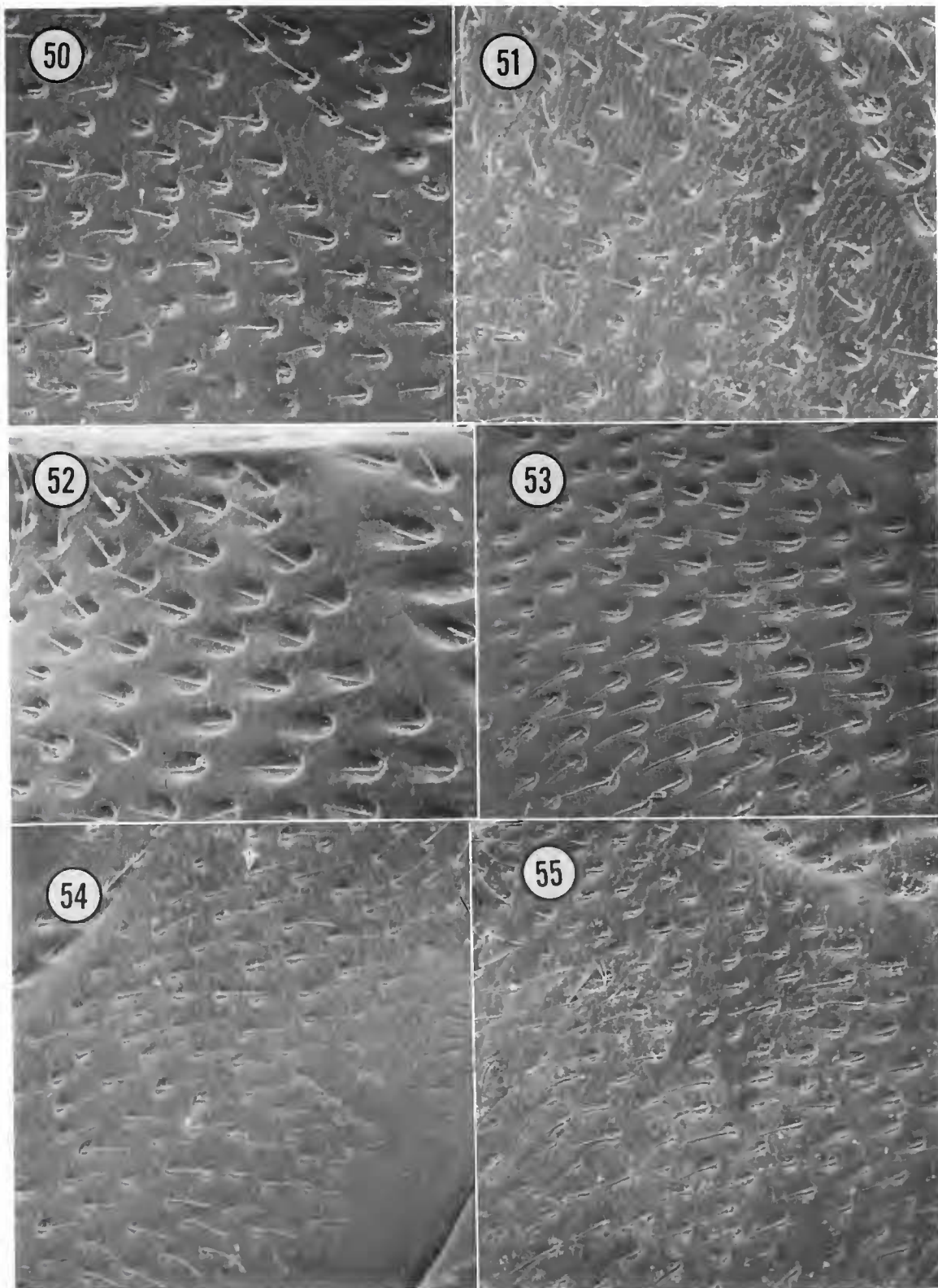
Hydroporus diversicornis Sharp 1882:437.

This is the most easily recognized of all of *Heterosternuta* because of the densely pubescent area (Figs. 40, 41) between the coxal lines in both sexes and the modified male antennae (Fig. 25). It also has dense, modified prosternal setae. This species has not previously been included in the *pulcher* group but is included in the subgenus on the basis of the following characteristics: 1; the length to width ratio is 2.0 in most specimens; 2; the unmodified clypeus; 3; the aedeagus is highly modified and atypical of the subgenus but is split at the tip; 4; finally prosternal bristles are present and this character has been found only within this subgenus.

Description.—Length 4.2 to 4.6 mm; width 2.15 to 2.3 mm. Form elongate oval, elytra parallel sided in basal half; elytra and pronotum continuous in outline, pronotal margin evenly curved towards anterior angles; with a flattened lateral bead which gradually widens anteriorly; at widest point about equal to width of last antennal segment. Modified prosternal setae distinct; prosternal process protuberant; with a distinct anterior file; process lanceolate posterior to procoxae.

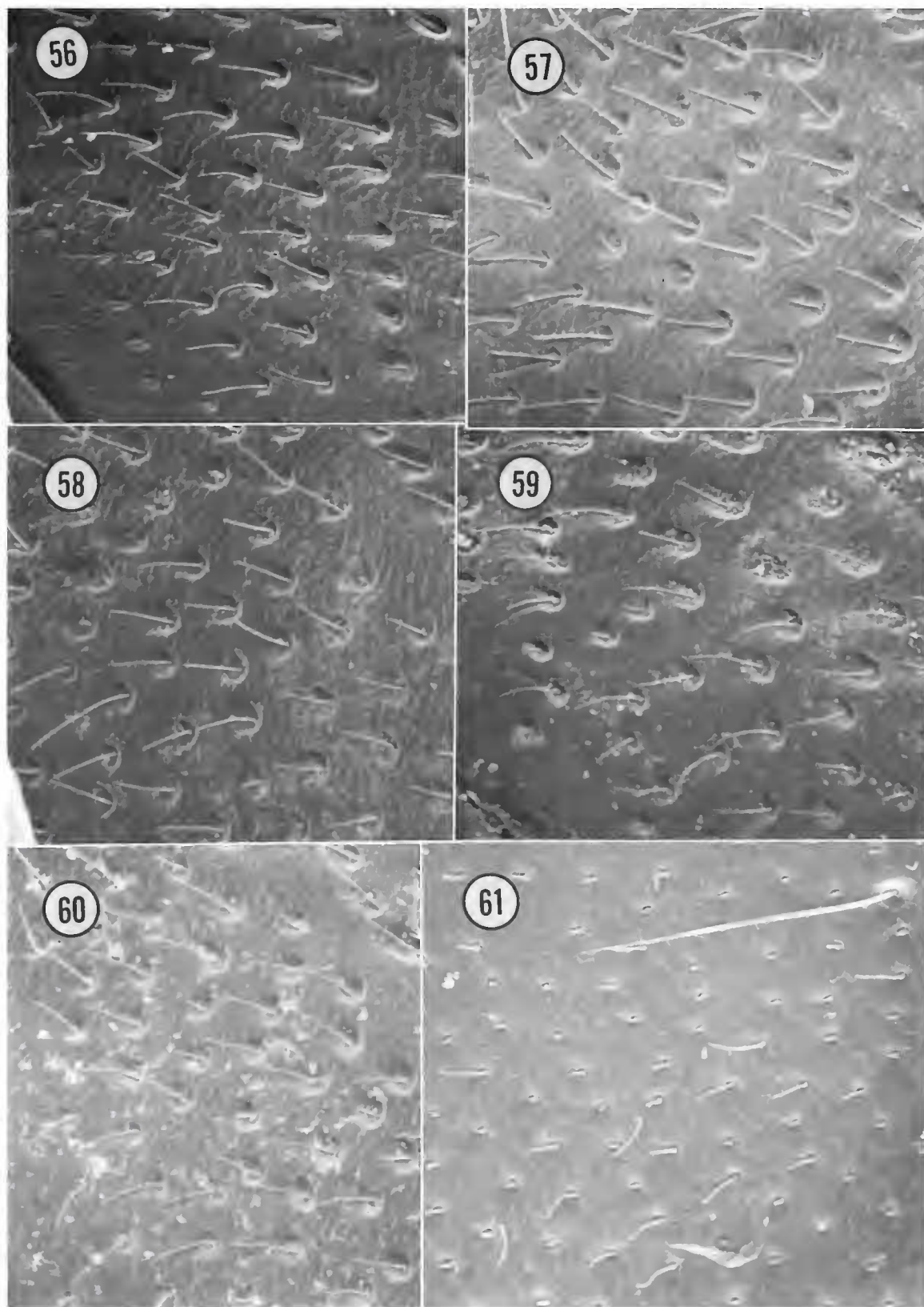
Strongly shining dorsally. Head, including antennae, and pronotum rufotestaceous; pronotum with an infuscation on the anterior margin which extends no more than $\frac{1}{2}$ of the distance to the lateral margin. Posterior margin with a narrow brown border. Elytra flavotestaceous with brown markings. Sutural stripe reduced to a narrow dark line bordering the suture. Dark markings consisting of a strongly undulating medial fascia which reaches the suture, a postmedian spot and postapical fascia which is usually connected along the suture to the medial fascia. Ventral surface rufotestaceous, somewhat lighter on the abdominal sterna.

Dorsal surface finely alutaceous, markedly so on the pronotum. Punctures



Figs. 50–55. Metacoxal punctation. Fig. 50. *H. ouachitus* (150×). Fig. 51. *H. laetus* (150×). Fig. 52. *H. cocheconis* (150×). Fig. 53. *H. diversicornis* (150×). Fig. 54. *H. wickhami* (150×). Fig. 55. *H. oppositus* (123×).

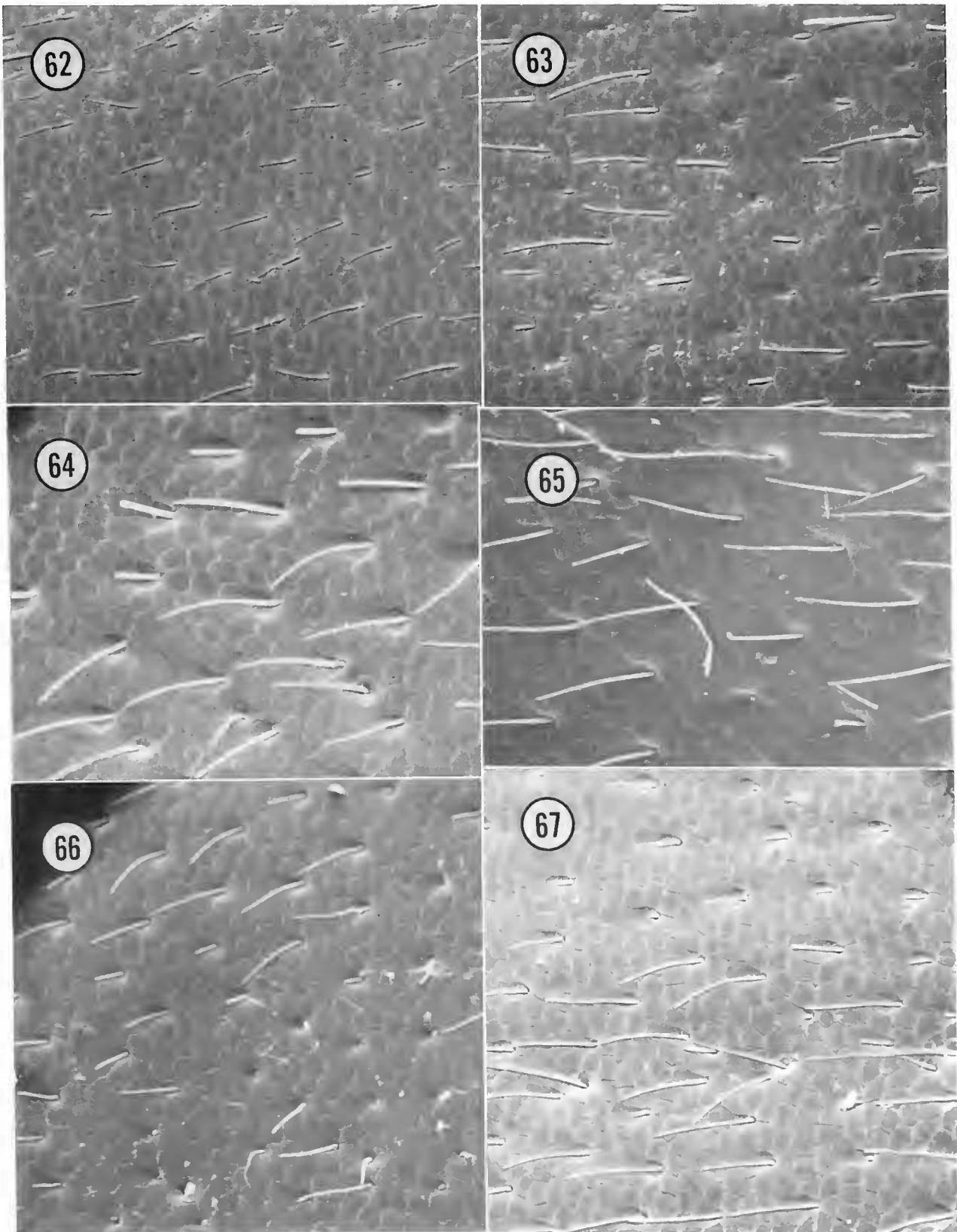
of head fine and sparse; pronotal punctation coarser and denser, punctures separated by up to 1 puncture width. Punctation of elytra (Fig. 72) about the same size as pronotal punctation but more densely applied; separated by $\frac{1}{2}$ a puncture width or less. Ventral surface with punctures of metastern-



Figs. 56–61. Metacoxal punctation. Fig. 56. *H. sulphurius* (150×). Fig. 57. *H. jenniferae* (150×). Fig. 58. *H. ohionis* (150×). Fig. 59. *H. folkertsi* (150×). Fig. 60. *H. jeanneae* (150×). Fig. 61. Elytral punctation, *H. pulcher* (350×).

num and metacoxae (Fig. 53) about the size of pronotal punctures; separated by $1\frac{1}{2}$ to 2 puncture widths. Abdominal punctures finer. The space between the coxal lines is covered with a dense pile of white hairs.

Male protarsi broadened; anterior protarsal claw shorter and slightly thicker than posterior claw. Male with middle antennal segments (Fig. 25)

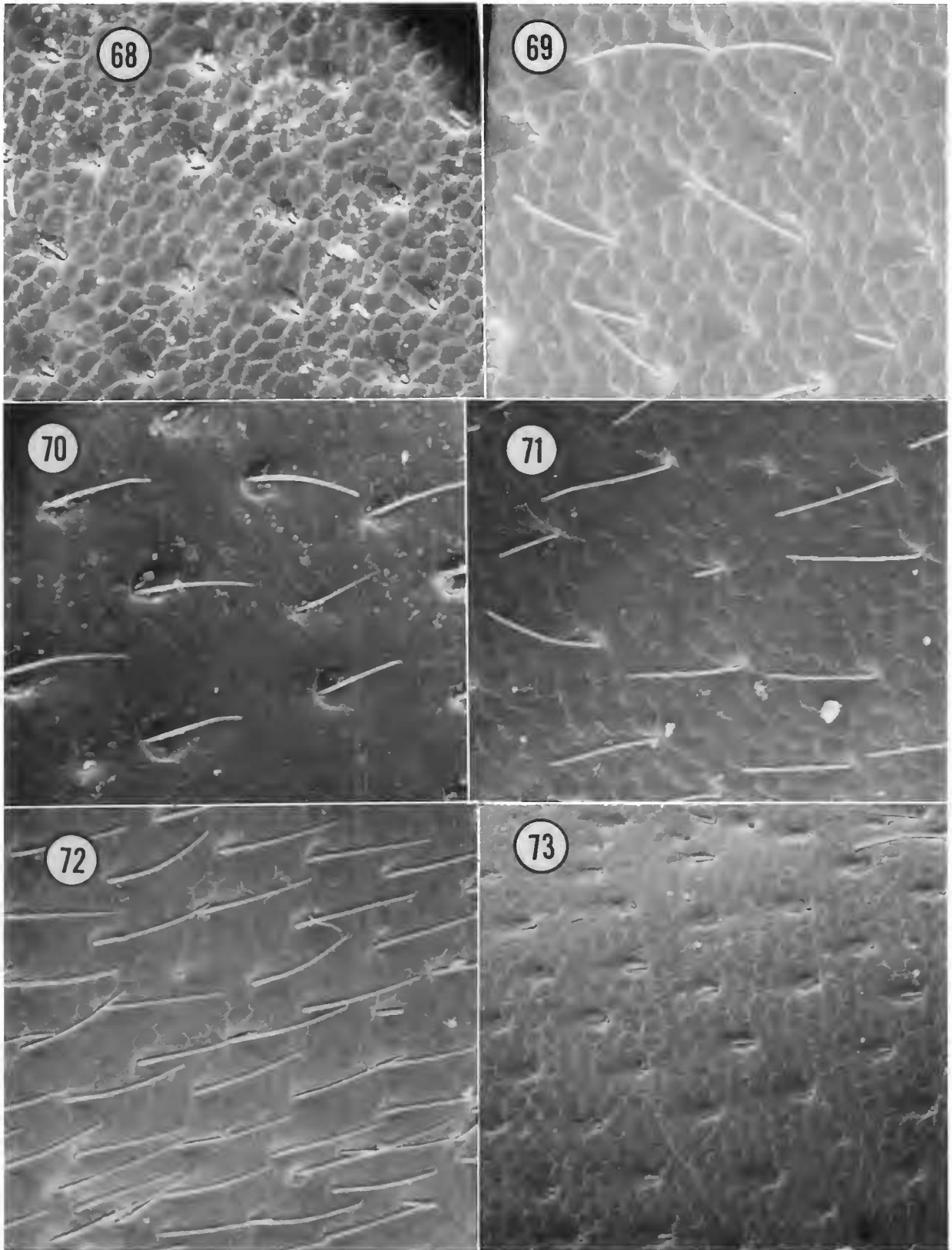


Figs. 62–67. Elytral punctation. Fig. 62. *H. wickhami* (308×). Fig. 63. *H. oppositus* (308×). Fig. 64. *H. cocheconis* (350×). Fig. 65. *H. alleghenianus* (350×). Fig. 66. *H. ouachitus* (350×). Fig. 67. *H. laetus* (350×).

broadened and flattened. Aedeagus decidedly aberrant; fully sclerotized dorsally and ventrally (Fig. 29).

Female similar to male except there is no protarsal or antennal modification and the pubescent area between the coxal lines is less dense.

Larvae.—Unknown.



Figs. 68–73. Elytral punctation. Fig. 68. *H. jenniferae* (400×). Fig. 69. *H. ohionis* (400×). Fig. 70. *H. folkertsi* (350×). Fig. 71. *H. sulphurius* (350×). Fig. 72. *H. diversicornis* (350×). Fig. 73. *H. jeanneae* (350×).

Type data.—The specimens on which Sharp based his description are presumably deposited at the British Museum of Natural History; however, we have not examined them.

Range.—Texas, Oklahoma and Kansas (Fig. 76).

Natural history.—We have collected this species from overhanging grassy banks beside flowing portions of streams in Texas. Occasional specimens have been reported from temporary ponds in Kansas.

Hydroporus folkertsi Wolfe and Matta

Hydroporus folkertsi Wolfe and Matta 1979:175.

The unusually elongate narrow form and very coarse punctation (Figs. 59, 69) distinguish this species. The aedeagus is similar to that of *ohionis* but that species has modified prosternal setae.

Description.—Length 3.0 to 3.4 mm; width 1.4 to 1.7 mm. Form quite elongate oval, very narrow, widest at middle. Lateral edges of pronotum evenly rounded toward the anterior angles, lateral bead distinct. Modified prosternal setae not present; prosternal prominence angulate but reduced; prosternal process lanceolate posterior to procoxae.

Rather strongly shining dorsally; head entirely pale yellow. Antennae pale yellow with articles 8 to 11 becoming gradually infusate. Pronotum with even broad brownish infuscation along the anterior margin, posterior infuscation restricted to the middle third with the anterior edge undulating; discal and lateral areas yellow. Elytra (Figs. 1, 2) with sutural stripe distinct and extending one third of the length of the elytral base. Middle and apical fascia not connected, usually connected to the sutural stripe. Ventral surface entirely yellowish.

Dorsal surface with perceptible reticulation, somewhat effaced on elytra. Punctation of head sparse and fine, denser on vertex between eyes, sparser anteriorly, densest in shallow depressions at antero-lateral corners of eyes. Pronotum with narrow area of denser punctures parallel to anterior margin, discal punctures slightly coarser, coarsest punctures along posterior edge in infuscation. Elytra (Fig. 69) with coarse and sparse punctures, somewhat less coarse laterally and apically; a vague lengthwise series of finer punctures evident in discal area and adjacent to suture. Ventrally metacoxae very coarsely and sparsely punctured (Fig. 59), metasternal punctures finer medially. Abdominal sterna finely punctate except sternum 1 and the anterior portion of 2.

Male protarsi scarcely broadened; anterior protarsal claw strongly bent at base, otherwise scarcely modified. Aedeagus with distinct narrow sub-apical projection located ventrally (Fig. 33).

Female with anterior protarsal claw gradually and evenly tapered and curved; female not otherwise discernible from male on the basis of external characters.

Larvae.—Unknown.

Type data.—The holotype and allotype are from a woodland stream 1.5 mi. N. of Praco on Co. Rd. 81, 18 Dec. 1977, collected by Jennifer, Jeanne

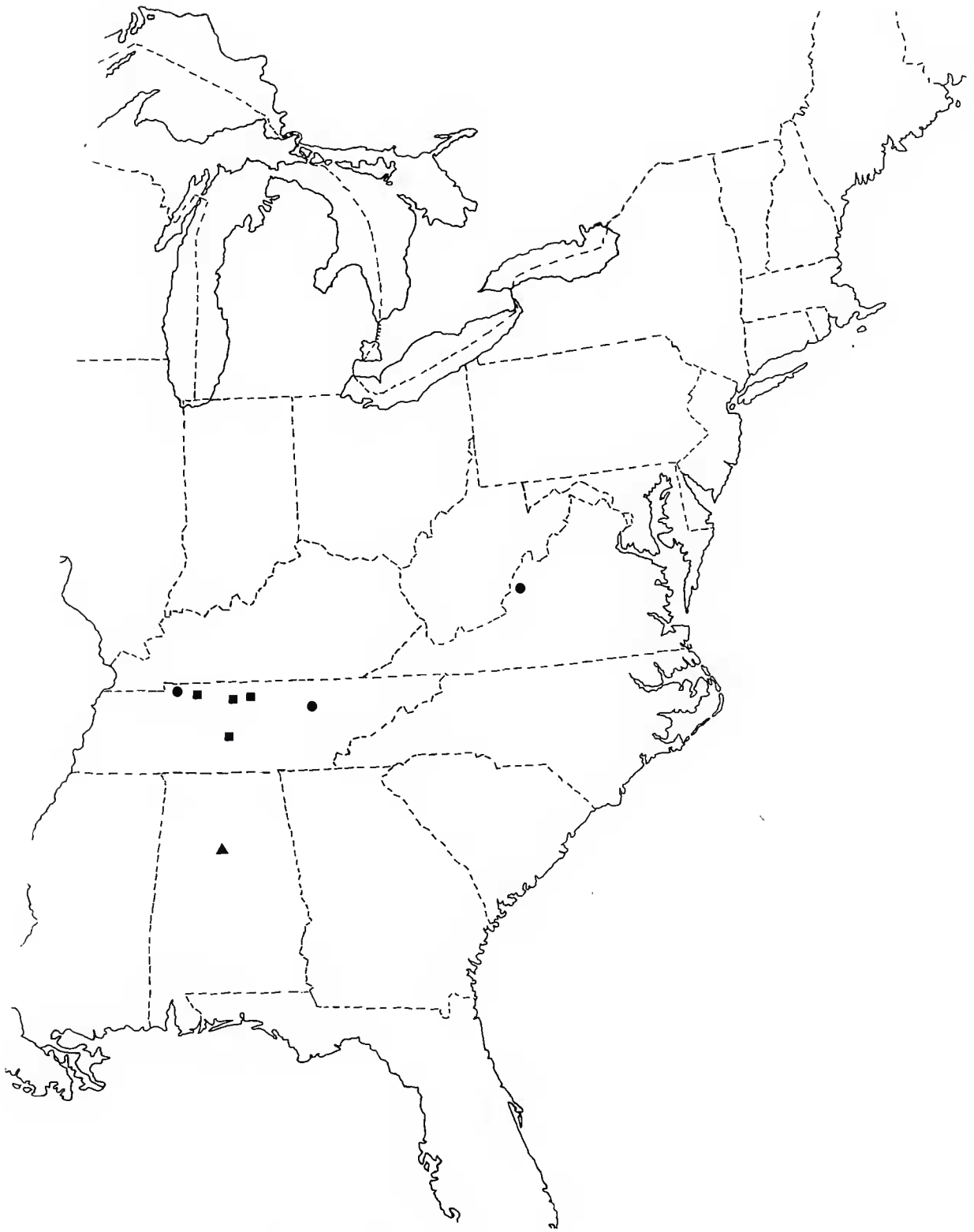


Fig. 74. *H. alleghaneanus* ●; *H. jeanneae* ■; *H. folkertsi* ▲.

and G. W. Wolfe. The primary types are in the NMNH with type number 75500.

Range.—Known only from the type locality in Jefferson Co., Alabama (Fig. 74).

Natural history.—The type locality is a small woodland stream (3 to 8 feet wide) with a gravel rock and rubble bottom. All specimens were taken

along the margin in overhanging grass and leaves. Both of the existing collections were made in January.

Hydroporus jeanneae Wolfe and Matta

Hydroporus jeanneae Wolfe and Matta 1979:174.

This species is quite easily distinguished by its unique elytral pattern which consists of a pale basal fascia and a large submedial dark brown fascia (Fig. 8). The combination of a uniformly reddish brown pronotum (Fig. 8) and the presence of prosternal setae is also a distinctive combination. The only other species which have a concolorous pronotum, *H. laetus* and *H. sulphurius*, lack prosternal setae and are also easily separated by aedeagus morphology.

Description.—Length 3.1 to 3.5 mm; width 1.6 to 1.8 mm; form evenly elongate oval, widest at middle, pronotum and elytra continuous in outline. Lateral margins of pronotum evenly rounded toward the anterior angles, lateral bead distinct and at maximum width about equal to the width of the second antennal segment. Modified prosternal setae distinct and dense; prosternal prominence distinctly angulate and somewhat produced; file composed of regularly placed transverse ridges (Fig. 47). Prosternal process lanceolate posterior to procoxae.

Not strongly shining dorsally; head light brownish yellow and vaguely infusate on each side of head between eyes and at occiput. Antennae light reddish yellow with eleventh segment infusate. Pronotum entirely dark reddish-brown, slightly darker anteriorly. Elytra (Fig. 8) with one large dark fascia in posterior half, pale yellow band across basal third and apical sixth; pale markings also evident in lateral areas of the discal fascia. Dark brownish sutural stripe extending from apex to base of elytra then laterally along the base to two thirds the width, expanding at middle of base. Ventral surface orange.

Dorsal surface with perceptible microreticulation. Punctuation on head sparse and fine, denser on vertex between eyes, finer anteriorly, densest in shallow depressions at antero-lateral corners of eyes. Pronotal punctuation finer medially, elytral punctuation coarser (Fig. 73), with a vague lengthwise series of discal punctures on elytra. Ventral punctuation (Fig. 60) coarser than dorsal punctuation, rather dense; punctuation of abdominal sternum 1 and anterior portion of sternum 2 very coarse, posterior portion of 2 and 3 through 5 finer.

Protarsi broadened; anterior protarsal claw strongly sinuate internally. The aedeagus is distinct (Fig. 28); it possesses posterolateral denticles and is deeply cleft.

Female similar to the male but slightly more alutaceous. Anterior tarsi

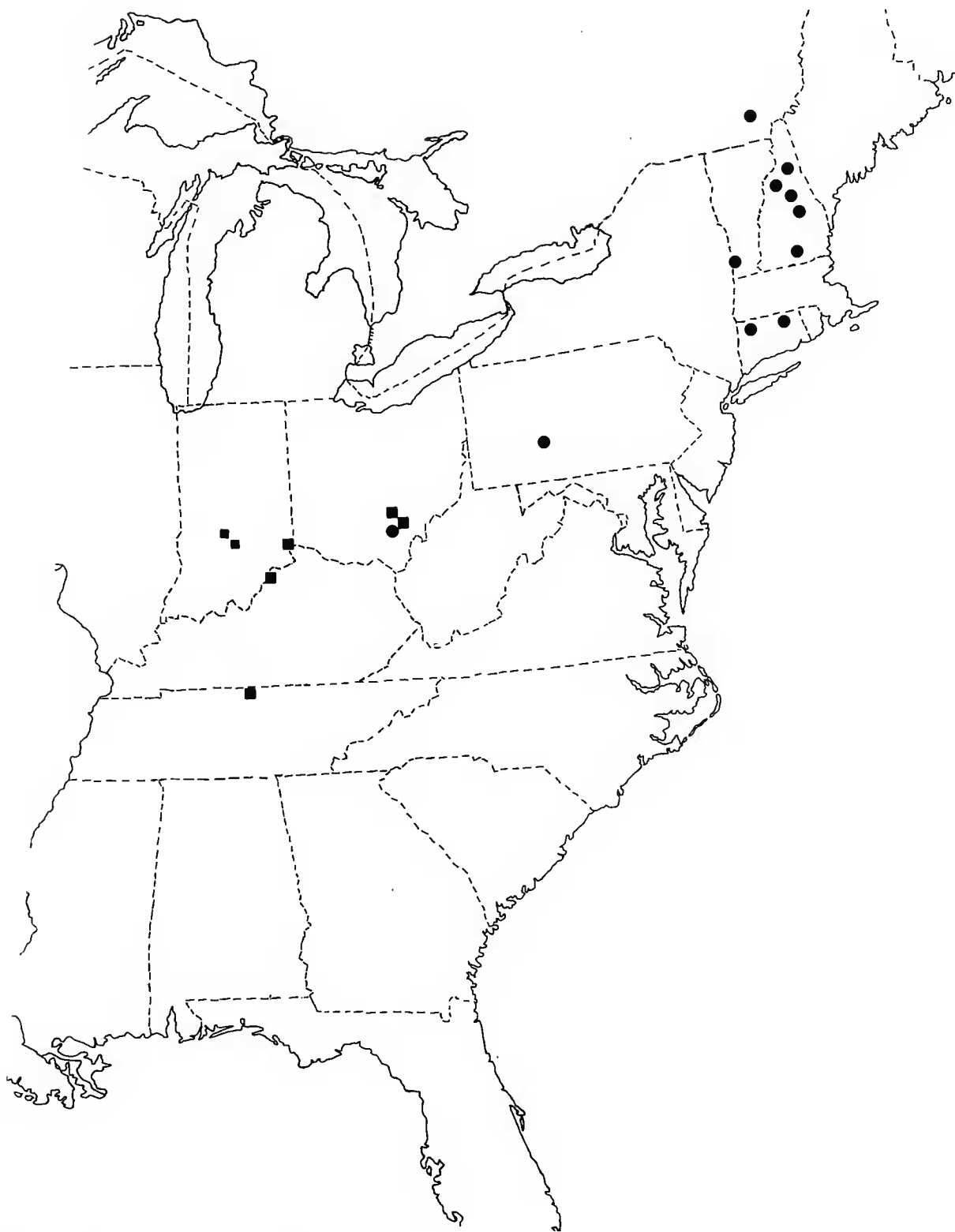
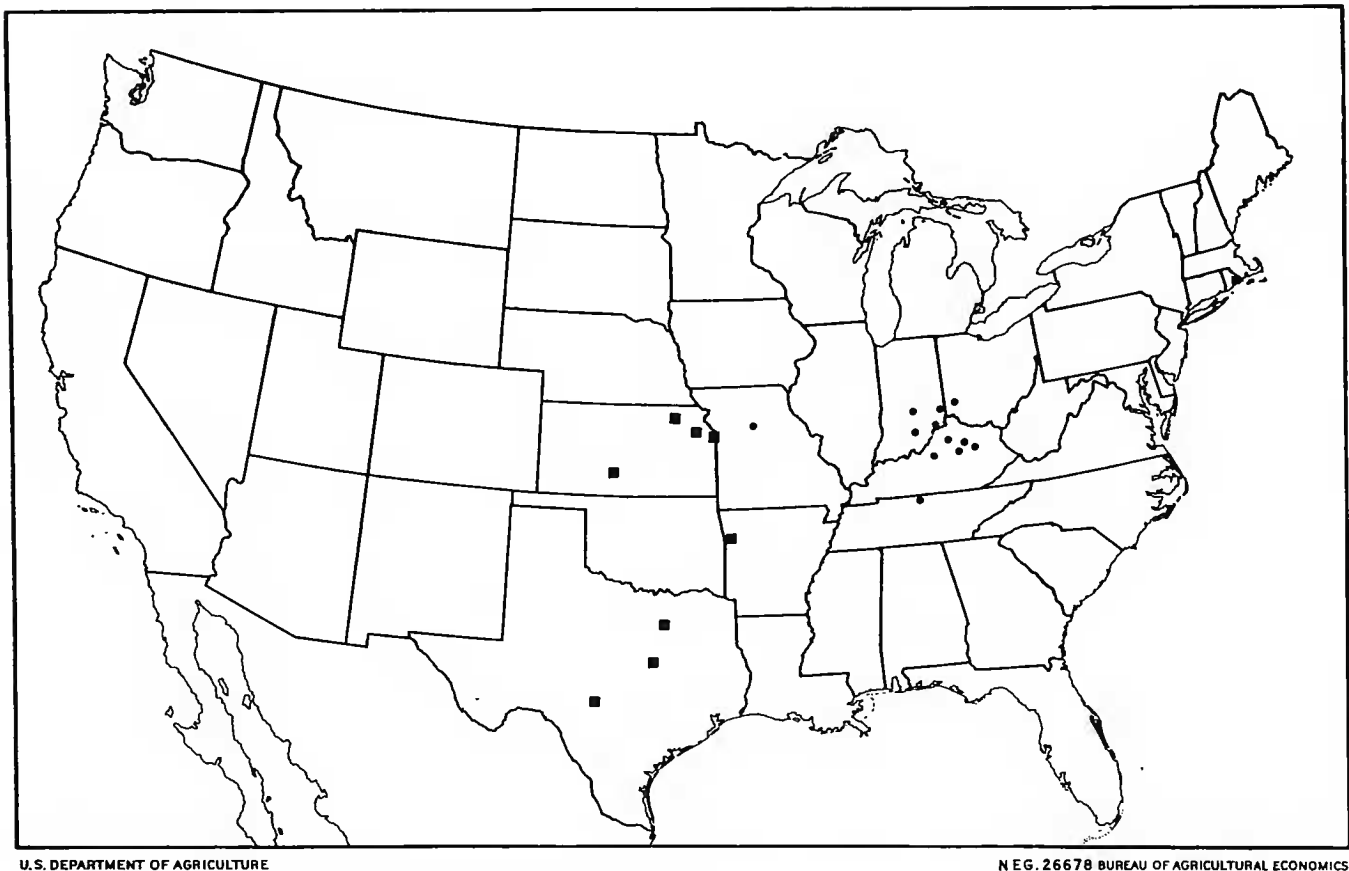


Fig. 75. *H. cocheconis* ●; *H. laetus* ■.

narrower and anterior protarsal claw evenly curved and tapering. The abdominal sterna are more infusate.

Larvae.—Unknown.

Type data.—The holotype and allotype are from Trousdale Co., TN, 1 mi. N. Barthelia on Hwy 231-10, 20 June 1977, and were collected by G. W. Wolfe and Jennifer and Jeanne Wolfe. The primary types are deposited in the NMNH with type number 75499.



U.S. DEPARTMENT OF AGRICULTURE

N E G. 26678 BUREAU OF AGRICULTURAL ECONOMICS

Fig. 76. *H. diversicornis* ■; *H. ohionis* ●.

Range.—This species has been collected only in central Tennessee (Fig. 74).

Natural history.—*Hydroporus jeanneae* prefers gravelly margins of streams and the fissures in large barely submerged slabs of bedrock. Leaves and algae were usually present.

Hydroporus jenniferae Wolfe and Matta

Hydroporus jenniferae Wolfe and Matta 1979:171.

This species is most closely related to *H. folkertsi* and *H. ohionis* but averages slightly larger and has a paler head than *ohionis* and is not as coarsely punctate as *folkertsi*. The apex of the aedeagus of *jenniferae* is ventrally deflected; appearing hook-shaped in lateral view.

Description.—Length 3.0 to 3.7 mm; width 1.4 to 1.7 mm; form evenly oval, widest at middle; pronotum and elytra continuous in outline. Lateral margins of pronotum evenly rounded toward the anterior angles; lateral bead distinct and at maximum width about equal to the width of the second antennal segment. Modified prosternal setae present but sparse. Prosternal prominence evidently angulate but not distinctly protuberant, prosternal file present rugose; prosternal process lanceolate posterior to procoxae, tip bluntly pointed.

Not strongly shining dorsally. Head pale yellow; vaguely infusate at

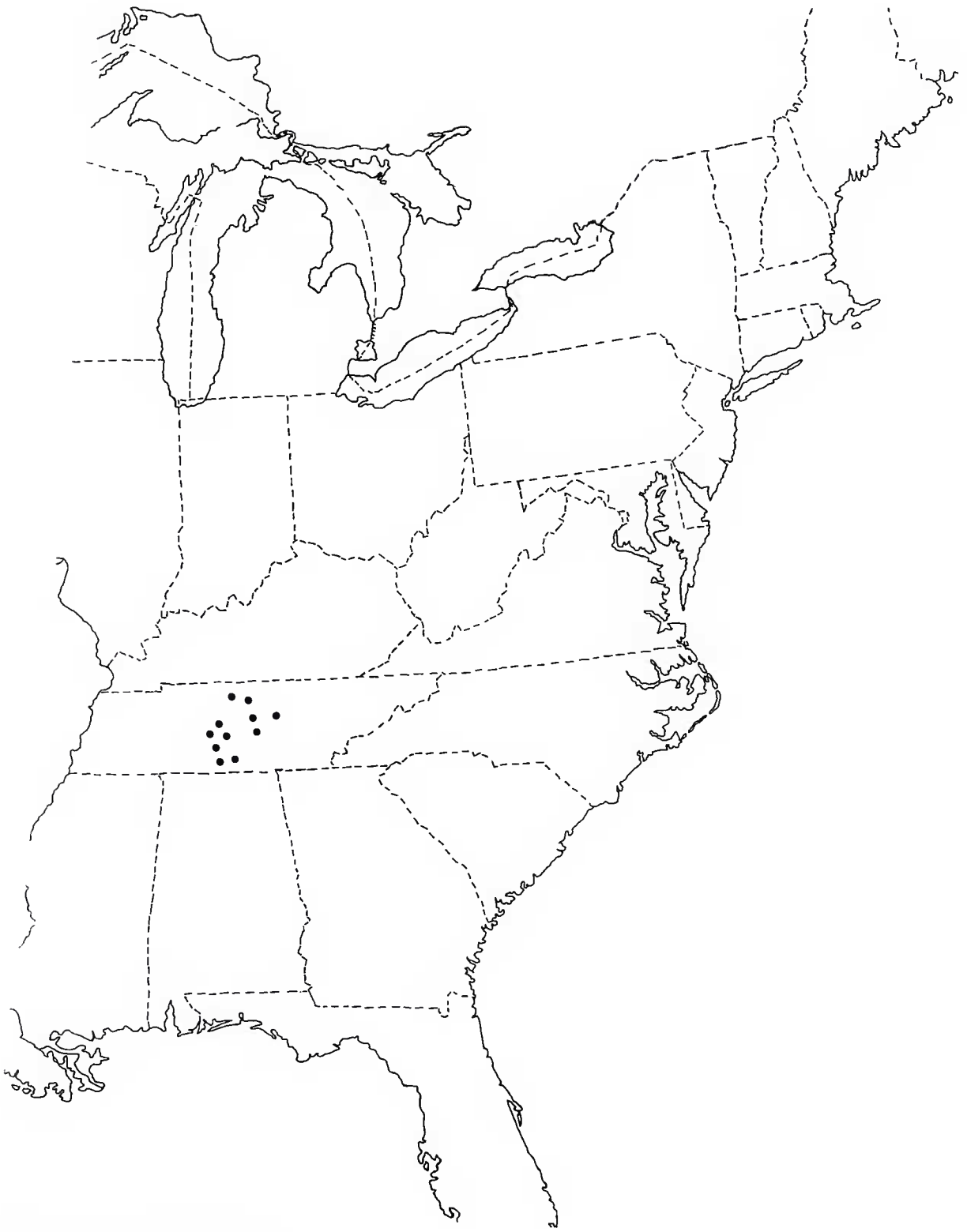
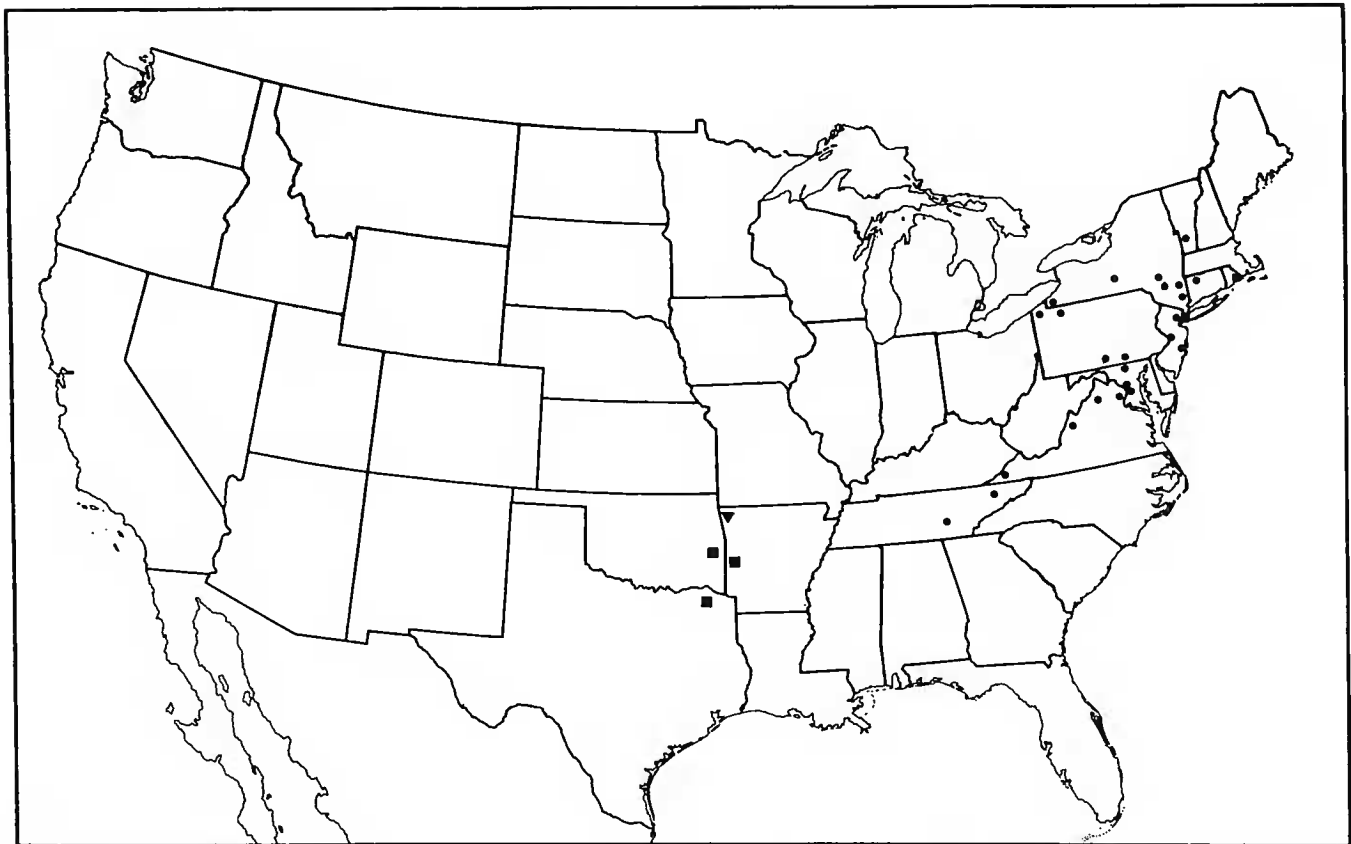


Fig. 77. *H. jenniferae* ●.

vertex, antennae pale yellowish with 11th segment infusate. Pronotum with an evenly broad black band along anterior edge. Posterior margin of pronotum with a black band of variable width, narrower on each side, expanding in undulating fashion and often coalescing with the anterior band. Paler isolated areas of the pronotum reddish yellow. Elytra (Figs. 3, 4) with distinct brownish black and yellow fascia. Sutural stripe distinct and extending along half the elytral base. Middle fascia large, indented in an undulating fashion; variable in extent. The middle fascia may be reduced and isolated



U. S. DEPARTMENT OF AGRICULTURE

NEG. 26678 BUREAU OF AGRICULTURAL ECONOMICS

Fig. 78. *H. oppositus* ●; *H. sulphurius* ▼; *H. ouachitus* ■.

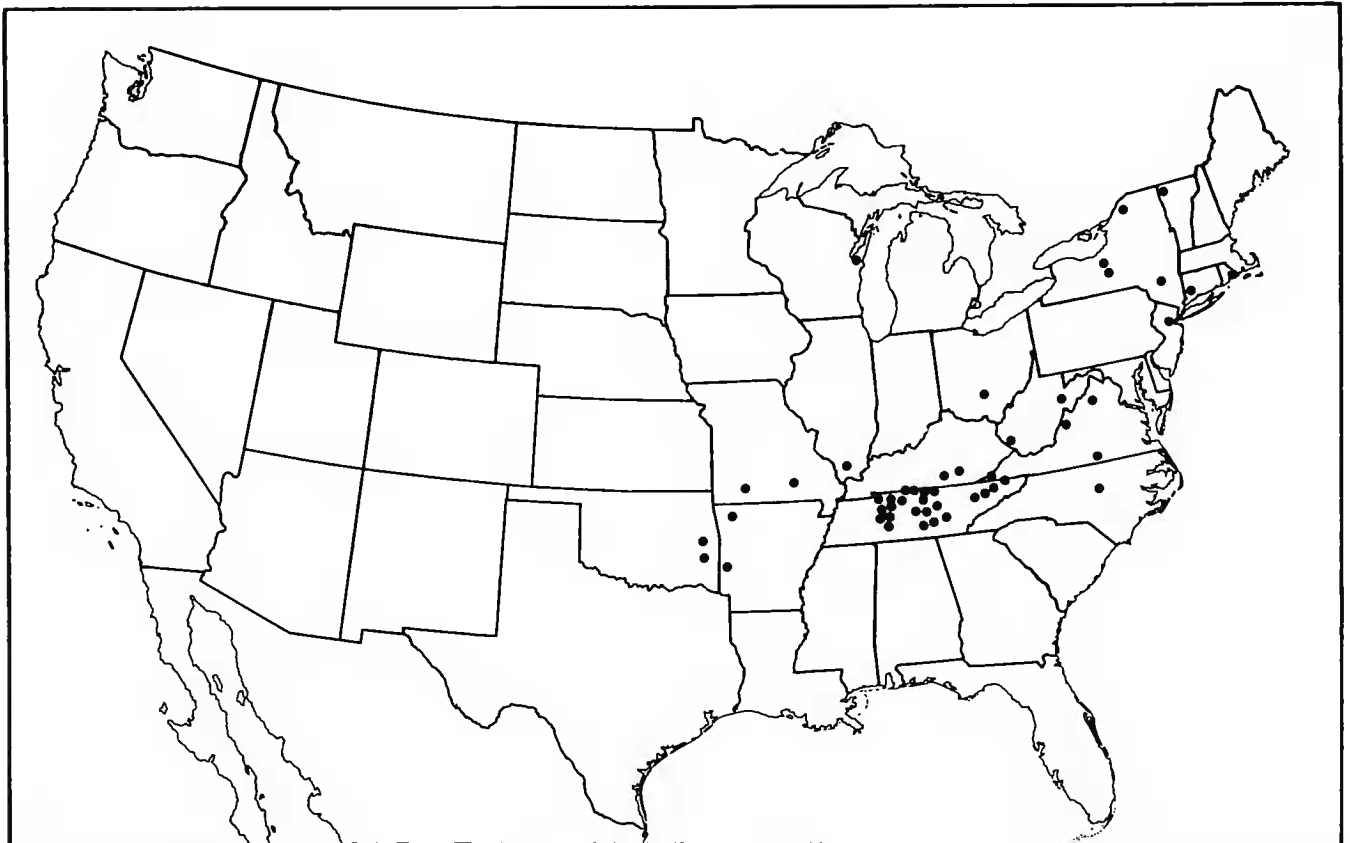
from the sutural stripe and the smaller apical fascia or it may be broadly connected to both. Ventral surface primarily reddish-yellow with mesosternum, lateral edges of metasternum, metacoxae and abdominal sterna variably infuscate.

Dorsal surface perceptibly reticulate; punctation of head fine and sparse, densest on vertex between eyes, sparser and finer anteriorly, densest in shallow depressions at antero-medial corners of eyes. Pronotum with a line of coarser and denser punctures parallel to anterior margin, discally punctures sparser and finer. The posterior prototal areas with punctures coarser and more or less restricted to the posterior infuscations.

Elytral punctation fine and sparse (Fig. 68), coarsest discally and finer laterally and apically. A very poorly defined lengthwise series of denser punctures is discernible in the discal area of each elytron. Ventrally metacoxa rather coarsely punctate (Fig. 57), metasternum even more so; medial punctures finer on both metacoxa and metasternum. Abdominal punctures coarser on sternum 1 and anterior portion of 2; posteriorly finer.

Protarsi of male relatively short and broad, anterior claw strongly bent at base and slightly sinuate internally. Aedeagus ventrally deflected at apex; appearing hook-shaped, with thin subapical ventral projection (Fig. 31).

Female similar to the male but slightly longer and broader. The anterior protarsal claw evenly curved and tapering. Abdominal sterna usually more infuscate.



U.S. DEPARTMENT OF AGRICULTURE

N E G. 26678 BUREAU OF AGRICULTURAL ECONOMICS

Fig. 79. *H. pulcher* ●.

Larvae.—Unknown.

Type data.—The holotype and allotype are from Trousdale Co., TN, 1 mi. N. Barthelia on Hwy 231-10, 20 June 1977 and were collected by G. W. Wolfe and Jennifer and Jeanne Wolfe. The primary types are deposited in the NMNH with type number 75498.

Range.—Known only from central Tennessee but its presence in central Kentucky is probable (Fig. 77).

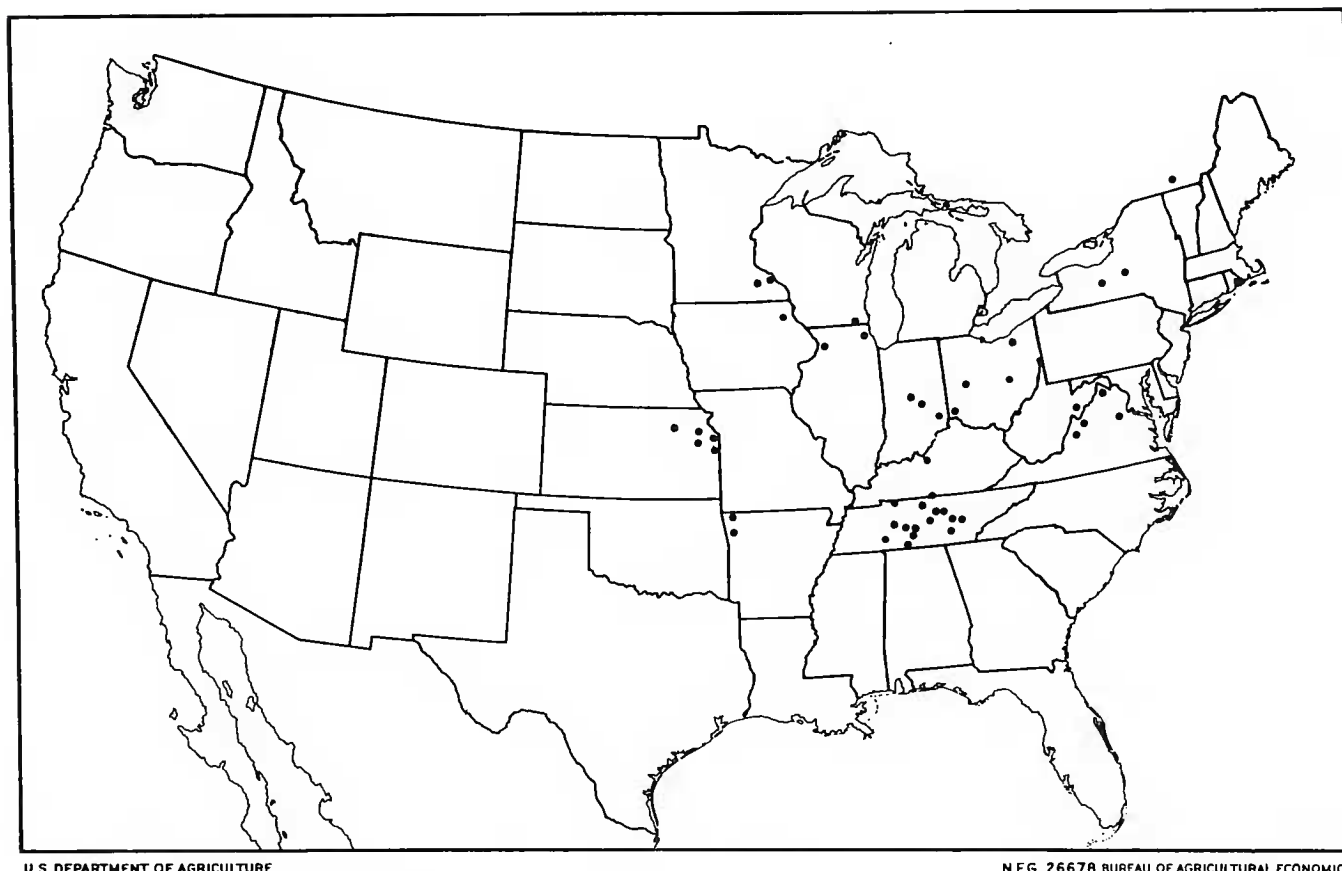
Natural history.—This species prefers gravelly stream margins. Many specimens were taken from a section of stream with extensive slabs of bedrock. The beetles were found among algae and leaves in fissures and depressions containing one to several inches of water.

Hydroporus laetus Leech

Hydroporus laetus Leech 1948:90.

This species is characterized by its uniformly dark reddish or brown pronotum and the absence of prosternal setae. The only other species in this subgenus with this combination of characters, *H. sulphurius*, has a distinct subapical ventral projection on the aedeagus and is so far known only from northwestern Arkansas.

Description.—Length 3.15 to 3.30 mm; width 2.0 to 2.15 mm; form elon-



U.S. DEPARTMENT OF AGRICULTURE

NEG. 26678 BUREAU OF AGRICULTURAL ECONOMICS

Fig. 80. *H. wickhami* ●.

gate oval, sides subparallel basally, widest at middle; pronotum and elytra continuous in outline. Lateral margins of pronotum evenly and gradually rounded towards the anterior angles; lateral bead distinct, gradually widening anteriorly, at maximum width about equal to the width of the second antennal segment. Prosternal prominence declivitous, somewhat protuberant. File area rugose, process lanceolate posterior to procoxae and bluntly pointed. Modified prosternal setae absent.

Shining dorsally, a little alutaceous. Head reddish or orange brown; clypeus lighter yellow. Pronotum reddish to reddish-brown. Elytra (Figs. 20, 21) with variable yellowish and brownish to blackish fascia which are usually as follows: sutural stripe distinct and extending about half the length of the elytral base, occasionally extending back. Middle and apical fascia connected to sutural stripe, separated from each other and not connected to the basal fascia. An infusate area present in the anterior light fascia.

Microreticulation evident; head randomly and finely punctate, punctures separated by 1 to 2 puncture widths; sometimes more coarsely punctate on vertex between eyes. Punctures finer anteriorly, densest in shallow depression at antero-medial corner of eye. Pronotal discal punctation sparse, fine, separated by the width of 2 to 3 punctures; somewhat coarser and denser parallel to the anterior margin. Elytral punctures fine and sparse (Fig. 67); separated by as much as 3 puncture widths. Ventrally metacoxal punctures

(Fig. 51) coarser than above, metasternal punctures coarser than those on the metacoxae; both becoming finer medially. Abdominal sternum 1 and anterior portion of 2 coarsely punctate, posteriorly finer.

Male protarsi scarcely modified; protarsi with anterior claw strongly bent basally, sinuate internally. Aedeagus and parameres as in Fig. 36. Female identical to the male except that the anterior protarsal claw is evenly and gradually tapered and curved.

Larvae.—Unknown.

Type data.—The holotype and allotype are from a stream adjacent to Lake Hope, Vinton Co., Ohio. They are deposited in the California Academy of Science. We have examined paratypes loaned by F. N. Young and from the Canadian National Collection.

Range.—The Great Lakes states to Pennsylvania, south to northern Tennessee (Fig. 75).

Natural history.—Teneral specimens were collected by Dr. F. N. Young on 22 September 1968. This species prefers the margins of streams.

Hydroporus ohionis Fall

Hydroporus ohionis Fall 1917:172.

This species is similar to *H. folkertsi*, *H. jenniferae* and *H. sulphurius*. *H. ohionis* is usually smaller, the head is more reddish and the aedeagus is unique. *H. sulphurius* has a uniformly dark pronotum and is known only from the northwestern portion of Arkansas. Furthermore, *H. sulphurius* and *H. folkertsi* lack prosternal setae.

Description.—Length 3.1 to 3.4 mm; width 1.4 to 1.5 mm; form elongate oval, widest at middle with pronotum and elytra continuous in outline. Lateral margins of pronotum gradually evenly curved toward the anterior angles. Lateral pronotal bead distinct, gradually broadening anteriorly; at widest point about equal to the width of the second antennal segment. Prosternum with stiff antecoxal setae; file area rugose; prosternal process lanceolate posterior to procoxae, bluntly pointed.

Shining but evidently alutaceous dorsally. Head orange, a little darker between the eyes. Pronotum orange to reddish discally, with broad dark bands along the anterior and posterior edges; the posterior band not extending as far laterally. These bands are sometimes sufficiently broad that the paler central band is narrow but the dark bands are rarely connected. Elytra with brown and yellowish fascia (Figs. 6, 7). Sutural stripe extending along basal edge for about half the width. Basal dark fascia narrow; middle fascia with uneven anterior and posterior margins; usually connected to the sutural stripe and rarely connected to the apical fascia; the apical fascia smaller. Ventrally dark orange, variably infusate on the abdominal sterna, especially laterally.

Microreticulation evident dorsally and ventrally. Head with fine sparse punctation, punctures separated by 1 to 2 puncture widths; finer on clypeus, densest in shallow depression at antero-medial corners of eyes. Pronotum sparse, finer discally, punctures separated by up to 4 puncture widths; denser and coarser along anterior and posterior edges. Elytra rather finely and sparsely punctate, punctures separated by 2 to 3 puncture widths (Fig. 69). Ventral punctation distinctly coarser; a little coarser on the metasternum than metacoxae (Fig. 58); both finer medially. Abdominal sternum 1 and anterior portion of 2 coarser, posterior portion of 2 and 3 to 5 finer.

Male with anterior tarsi scarcely modified, anterior claw bent basally but only feebly sinuate. Aedeagus with a thin subapical ventral projection (Fig. 32).

Female very similar to the male. Anterior protarsal claw gradually tapering and curved.

Larvae.—Unknown.

Type data.—Fall's description of this species is based on three males from Cincinnati, Ohio, but he did not designate a type specimen. We have designated as the lectotype of *Hydroporus ohionis* Fall the male specimen from Fall's type series which we have dissected. The specimen bears the following label information: Cincin. Ohio; a small label with the male sex symbol and a label bearing the words H. C. Fall Collection. We have placed a yellow lectotype label on this specimen with the following information: Lectotype, *Hydroporus ohionis*. This specimen has been returned to the Museum of Comparative Zoology, Harvard.

Range.—The Great Lakes states to Pennsylvania and south through Kentucky and Virginia (Fig. 76).

Natural history.—This species seems to prefer the margins of small streams with sand or fine gravel substrates and overhanging vegetation. It is frequently collected in the submerged roots of grass clumps at the stream margin and is occasionally taken from small backwaters.

Hydroporus oppositus Say

Hydroporus oppositus Say 1823:289.

Diagnosis.—This species is most easily separated from the closely related *H. wickhami* by the apex of the aedeagus which is more prolonged (Figs. 26, 27) in lateral view; however, it also averages larger and is somewhat less infuscated and more coarsely punctate ventrally. In the southeastern portions of its range *H. oppositus* is distinctly fasciate with blackish and yellow fascia. In the northeast the darker elytral fascia are reddish and expanded, almost obliterating the yellow fascia. In the south the anterolateral angles of the pronotum are sinuate and the anterior protarsal claw of the male is markedly sinuate (Fig. 39).

Description.—Length 3.4 to 4.1 mm; width 1.7 to 2.1 mm. Form elongate oval, widest at middle with pronotum and elytra continuous in outline. Lateral edges of pronotum gradually curved inward but sometimes slightly sinuate at the antero-lateral corners. Lateral pronotal bead distinct, about as wide as the second antennal segment; gradually broadening anteriorly. Distinct stiff prosternal setae present. Prosternal prominence angularly declivitous, file composed of regularly placed transverse ridges. Prosternal process lanceolate posterior to the procoxae, bluntly pointed.

Dorsally shining. Head flavotestaceous, infusate in back of the eyes across vertex. Pronotum with even broad dark band along anterior edge; infusate along the posterior edge but this infuscation not as dark or as broad; discal area rufotestaceous. Elytra with yellow and brownish black fascia (Figs. 17–19). Sutural stripe distinct and extending laterally along the basal edge up to two thirds of the elytral width; then extending posteriorly. This posterior extension is often isolated, forming a discreet spot and is seldom connected to the middle fascia. Middle dark fascia large, undulating, occasionally deeply indented, connected to the sutural stripe; variably connected with the posterior dark fascia. Posterior dark fascia smaller, usually not deeply indented. Ventral coloration variable, usually darkly infusate, medial areas of metacoxae, metasternum and abdominal sterna often rufotestaceous.

Microreticulation evident dorsally and ventrally. Punctuation of head fine, usually denser on vertex, punctures separated by one half to one puncture width, becoming finer anteriorly; densest in shallow depressions at antero-lateral corners of eyes. Pronotal punctuation coarse; separation variable but up to 2 puncture widths; often finer and sparser medially; a line of coarser punctures parallel to anterior edge. Elytral punctuation a little coarser (Fig. 63), separated by 1 to 1 and one half puncture widths. Ventral punctuation coarser than above; metacoxae (Fig. 55) and metasternum finer medially. Punctures of abdominal sternum 1 and anterior portion of 2 coarser, posteriorly finer.

Anterior protarsi of male broadened, protarsal claw sinuate, usually lobed (Fig. 39). Aedeagus as in Fig. 26. Female similar to male; more alutaceous; anterior protarsal claw evenly tapered and curved.

Larvae.—Described in Barman (1972).

Type data.—Say's types are generally considered to be lost. Since no material suitable for designation as a neotype was available from the LeConte collection (a usual source for specimens representative of Say's species) a male specimen from Pendleton County, West Virginia is designated as a neotype of *Hydroporus oppositus* Say. This specimen is typical of northeastern specimens of *oppositus* and fits Fall's interpretation of *H. oppositus* Say. The specimen bears the following labels; 1, Pendleton Co., W. Va., V-3-74, Matta; 2, *Hydroporus oppositus* Say, Det. J. F. Matta; 3,

Neotype *Hydroporus oppositus* Say. des. 1980 JFM. This specimen has been deposited in the Museum of Comparative Zoology, Cambridge, MA.

Range.—*Hydroporus oppositus* extends from eastern Canada and New England south to North Carolina and Tennessee (Fig. 78).

Variation.—This species exhibits interesting variation in a north-south direction throughout its range and Fall's (1923) analysis, which is based on northeastern specimens, can be misleading if applied to southern material. In the south this species closely approaches *H. wickhami* in coloration; the ventral infuscation is reduced and the dorsum is distinctly fasciate. Specimens with this coloration possess a distinctly sinuate and lobed anterior protarsal claw and the anterior pronotal margin is sinuate. Specimens from more northern areas have the dark fascia expanded and in New England specimens the dark fascia are usually broadly connected and the light yellow fascia reduced to isolated spots. As the coloration becomes progressively more infuscate (nonfasciate) the pronotal sinuation disappears (it is rare in Virginia specimens and absent in material from Pennsylvania and New York) and the anterior protarsal claw becomes less sinuate (the sinuation is scarcely detectable in northern material). In addition *H. oppositus* becomes gradually smaller in the northern part of its range.

Natural history.—This species is usually taken at the margins of streams with gravel margins. It is commonest in smaller and intermittent streams.

Hydroporus ouachitus Matta and Wolfe

Hydroporus ouachitus Matta and Wolfe 1979:289.

Diagnosis.—This species is best identified by the shape of the male genitalia. It is similar to *H. pulcher* but may be separated from that species by the coarser ventral punctation, smaller size and reduction of the anterior pronotal dark spot and distinctly different aedeagus (Fig. 37). The aedeagus is similar to that of *H. laetus* but that species has a uniformly reddish pronotum. The punctation (Fig. 64) is finer than in *H. cocheconis* (Fig. 66) and the presently recorded ranges are allopatric.

Description.—Length 2.80 to 3.20 mm; width 1.35 to 1.45 mm. Form elongate oval, widest at middle; pronotum and elytra continuous in outline with the sides of the elytra very slightly concave basally. Lateral pronotal bead distinct, slightly widened anteriorly. Modified prosternal setae absent although a few short stiff hairs may be present on the prosternum at the base of the coxae. Prosternal process distinctly angulate, prosternal file present but poorly developed. Posterior half of the prosternal process broadly lanceolate with the medial portion slightly rounded and lateral edges margined; the tip bluntly pointed.

Head reddish brown, antennae with last segment infuscate. Pronotum reddish brown with a diffuse dark spot at the anterior margin which reaches

from the central line to approximately half the distance to the margin on each side. Posterior margin of pronotum with a thin dark band which narrows laterally. Elytra (Fig. 12) dark brown with subbasal, postmedial and apical pale areas which are separated from the sutures and the lateral margins by thin dark bands. Ventral surface yellow-brown, the legs, prosternum and head reddish brown.

Dorsal surface finely and densely microreticulate; punctation of head fine; punctures separated by 3–4 times the width of a puncture. Pronotum with discal punctures similar to those of the head; with a band of coarser punctures near the anterior margin and with a few coarse punctures scattered along the posterior margin. Elytra rather evenly punctured (Fig. 66), the punctures separated by 1 to 1½ a puncture width. Ventral punctation coarser; the metacoxae (Fig. 50) and metasternum with the punctures separated by less than ½ a puncture width. The abdominal punctures fine, slightly coarser basally.

Male with pro- and mesotarsi short and thickened; the anterior protarsal claw not modified; aedeagus as in Fig. 37. Female similar to the male but averages 0.1 mm longer. There is some minor variation in color pattern but all extant specimens are quite similar.

Larvae.—Unknown.

Type data.—The holotype, allotype and 11 paratypes are from a small stream 2 mi. s of Mena, Arkansas, 19 July 1978, collected by J. F. Matta. The primary types are in the collection of J. F. Matta but have NMNH type number 75966.

Range.—Texas, Arkansas and Oklahoma (Fig. 78).

Natural history.—The type series was collected from the margins of a pool in the bedrock of a small temporary stream. Most specimens were washed out of the roots and sand near grass and bushes which extended partly into the pool.

Hydroporus pulcher LeConte

Hydroporus pulcher LeConte 1855:298.

This is one of the most widely distributed species in the subgenus. It may be easily recognized by the extremely fine ventral punctation (Fig. 61) and by the form of the aedeagus (Fig. 38).

Description.—Length 3.1 to 3.6 mm; width 1.6 to 1.8 mm. Form elongate oval, widest at middle; length to width ratio usually greater than or equal to 2, however occasional specimens are slightly broader; pronotum and elytra continuous in outline. Lateral margins of pronotum evenly rounded toward anterior angles, lateral bead distinct, widening slightly anteriorly; at maximum width about equal to the width of second antennal segment. Modified prosternal setae absent. Prosternal prominence declivitous, not dis-

tinctly protuberant, prosternal file quite rugose, prosternal process broadly lanceolate posterior to procoxae, bluntly pointed.

Shining dorsally. Head uniformly pale yellow; antennae yellow with terminal segment vaguely and variably infusate. Pronotum with even black band along entire anterior edge; posterior margin with narrow medial black band extending across $\frac{2}{3}$ of the edge. Disc and lateral margins yellow. Elytra (Figs. 22–24) with distinct undulating yellow and black fascia. Sutural stripe distinct and extending along basal edge $\frac{1}{2}$ to $\frac{2}{3}$ of the width to form a basal fascia. Basal fascia extending posteriorly in some specimens occasionally coalescing with middle fascia, sometimes this posterior extension isolated as an anterolateral spot. Middle dark fascia large, usually coalescing with sutural stripe, at maximum extent coalesced with basal and apical fascia; sometimes isolated from all three. Apical fascia smaller than middle, showing same variation as middle fascia. Venter yellow, metacoxae usually lightest, sutural and lateral areas and abdominal sterna sometimes lightly infusate; mesosternal area darkest.

Microreticulation evident on head and pronotum, reduced on elytra and ventrally. Punctuation of head fine, randomly punctate; usually coarser and denser on vertex between the eyes; finer and sparser anteriorly, densest in shallow depressions at anteriomedial corners of eyes. Pronotal punctuation fine; punctures separated by 1 to 2 puncture widths; a line of coarser punctures parallel to anterior margin. Elytral punctuation (Fig. 61) finer than pronotum except at extreme base; punctures separated by about 2 puncture widths. Punctuation of metacoxae (Fig. 48) and abdominal sterna fine, dense; separated by less than 1 puncture width on metacoxae. Metasterna with punctures a little coarser and sparser laterally.

Protarsi of male slightly modified; anterior protarsal claw slightly sinuate on inner margin; strongly bent basally. Apical portion of aedeagus broadly dorsoventrally flattened, with minute subapical ventral projection (Fig. 38).

Female identical to male except that the anterior protarsal claw is evenly curved and tapered.

Larvae.—Unknown.

Type data.—The type specimen is in the MCZ and bears type number 6004. It is from Alabama and was collected by Mr. Hentz.

Variation.—This species is rather uniform throughout its range except that some northern specimens have the darker elytral fascia broadly coalesced and appear almost completely dark.

Range.—Southern Canada south to Virginia; west to Wisconsin and Arkansas. The Minnehaha, Arizona, specimen mentioned by Fall probably represents a mislabeled specimen from Minnehaha, West Virginia (Fig. 79).

Natural history.—Teneral specimens were taken in June and August. This species is found in a wide variety of stream habitats but is most frequently collected from gravel margins of smaller streams.

Hydroporus sulphurius Matta and Wolfe

Hydroporus sulphurius Matta and Wolfe 1979:287.

The unicolorous (infusate) pronotum and lack of prosternal setae separate this species from all others in the subgenus except *H. laetus*. The punctures of *H. sulphurius* are slightly smaller and sparser than *laetus* and the elytral markings are darker. In addition the ranges of the two species are allopatric. The aedeagus of *H. sulphurius* is distinct (Fig. 30) and may be used to separate it from all species in the genus.

Description.—Length 2.9 to 3.5 mm; width 1.4 to 1.7 mm. Form elongate oval; widest at middle; pronotum and elytra continuous in outline with the lateral margins of the pronotum evenly rounded towards the anterior angles. Margin of pronotum with a distinct lateral bead which appears flattened on top and which is about $\frac{1}{2}$ as wide as the last antennal segment. Modified prosternal setae absent; prosternal process with an angulate protuberance and a poorly defined anterior file. Prosternal process lanceolate posterior to the procoxae and with a bluntly rounded tip.

Head pale brown; antennae concolorous with head, vaguely infusate on last segment. Pronotum uniformly reddish brown; lateral margins lighter. Each elytron (Fig. 5) reddish brown with anterior, postmedial and posterior light brown pale patches which extend across the width of the elytron and terminate against the sutural stripe. The postmedial spot is interrupted by a narrow dark band cutting across its middle and the apical spot extends anteriorly as a vague narrow streak but does not reach the postmedial spot. Ventral surface light brown with the metacoxal plates, metasternum and prosternal process slightly darker.

Finely and distinctly alutaceous dorsally. Head sparsely and finely punctured. Pronotum with disc finely punctured; with a narrow band of coarse punctures near the anterior margin and a broader band of coarse punctures on the posterior margin. Elytral punctures (Fig. 71) fine and sparsely distributed; separated by at least the width of 1 puncture, usually by the width of several punctures. Ventral surface finely punctured except for the metacoxal plates (Fig. 56) and metasternum where the punctures are 4–5 times larger than normal.

Protarsal claw and protarsi of male unmodified. Aedeagus as in Fig. 30; with a thin subapical ventral projection. Female similar to the male in external characters.

Larvae.—Unknown.

Type data.—The holotype, allotype and all paratypes are from Sulphur Springs, Arkansas, VII-20-1955, collected by P. J. Spangler. The holotype and allotype are in the NMNH and have type number 75967.

Variation.—In the small series available there is little variation. A few

specimens have a small vague paler area on the disc, there may be a dark spot at the anterior edge of the anterior elytral spot and the postmedial pale spot may be reduced or split by a dark streak. The dark areas on the ventral surface vary from the typical reduced dark area to large infusate patches on the abdominal sterna.

Range.—Known only from Sulphur Springs, Arkansas (Fig. 78).

Natural history.—This species has been collected from only one site on the Ozark plateau in an area of numerous springs and small sand bottom streams. No specific habitat data is available for this species however it is probably found at the margins of the smaller streams.

Hydroporus wickhami Zaitzev

Hydroporus wickhami Zaitzev 1907:114.

This species can be separated from most other species in the subgenus by the presence of dense prosternal setae and a blackish venter. It is difficult to separate from *H. oppositus* and the discussion of that species should be referred to for distinguishing characters.

Description.—Length 3.3 to 3.7 mm; width 1.5 to 1.9 mm. Form elongate oval, widest at middle; with pronotum and elytra in continuous outline. Lateral margins of pronotum gradually and evenly curved toward anterior angles. Lateral margins of pronotum with a distinct bead which gradually broadens anteriorly; at its greatest width approximately as wide as the second antennal segment. Distinct stiff prosternal setae present. Prosternal process with angular prominence, file composed of regularly placed transverse ridges; process lanceolate posterior to the procoxae; apex bluntly rounded.

Dorsally shining, occasionally somewhat alutaceous. Head yellowish orange; vaguely infusate across vertex behind eyes. Pronotum with even broad dark band on anterior margin; posterior margin with a narrower dark band. Elytra markings (Fig. 16) yellow and brown to black. Sutural stripe extending length of suture and $\frac{2}{3}$ of way along elytral base, then backward toward medial dark fascia. Medial fascia large, deeply indented and connected to sutural stripe; sometimes barely connected to apical dark fascia. Apical dark fascia smaller, usually connected to sutural stripe. Venter dark; black to reddish black; area between metacoxal lines and abdominal sterna often more reddish. Legs, prosternum and ventral side of head rufotestaceous.

Microreticulation evident dorsally and ventrally. Punctuation of head fine, punctures separated by 1 to 2 puncture widths; denser on vertex between eyes, finer anteriorly and coarsest and densest in shallow depressions at anteromedial corners of eyes. Pronotal punctuation fine and dense; punctures

separated by 1 to 2 puncture widths; a line of coarse punctures parallel to anterior margin. Elytral punctation fine (Fig. 62); punctures separated by 2 to 3 puncture widths; a discal longitudinal line of coarse punctures evident. Metacoxae (Fig. 54) and metasternum more coarsely punctate. Punctures on abdominal sternum 1 and posterior region of 2 coarser; those on the rest of 2 and 3–5 finer.

Anterior protarsi of male broadened; anterior protarsal claws feebly sinuate. Aedeagus distinct (Fig. 27). Female identical to male except that the protarsi are narrower and the anterior protarsal claws are gradually and evenly curved.

Larvae.—Described in Barman (1972).

Type data.—There are two specimens in the type series, a male and a female. The female bears a type label with the type number 6007; however a type designation has never been published and we are designating the male (which we have dissected) as the lectotype and the female as the paralectotype. The type locality is given as Fort Laramie, Nebraska; however, this is now Wyoming (Fall, 1923).

Range.—Southeastern Canada south to north Georgia, west to Kansas and Wisconsin (Fig. 80). The type is recorded from Wyoming; however, we have not seen other specimens from this far west.

Natural history.—This species is found in many stream habitats but is most common at the margins of medium to small streams.

Discussion

The subgenus *Heterosternuta*, as here redefined, is composed of a monophyletic group of species. These species are characteristically found along the margins of piedmont or mountain streams and all but two species are found east of the 100th meridian. The subgenus presents some interesting problems and areas for future work. Barman (1972) has described the larvae and biology of *H. oppositus* and *H. wickhami*; however, the larval and pupal stages of all other species are undescribed and the life history of most species are unknown. The role of the subgenus in the stream community also needs study. They frequently occur in large numbers—particularly in temporary streams—and may have a significant impact on the small invertebrates which presumably make up the major portion of their diet. They are rarely reported in stream surveys however since most stream sampling procedures neglect the stream margins.

A particularly interesting problem is presented by the prosternal setae which are present in several species. These bristles do not appear in any other North American *Hydroporus* and vary in size and number between the species of *Heterosternuta*. Their function is unknown and it would be interesting to know their biological function.

Literature Cited

- Barman, Jr., E. H. 1972. The biology and immature stages of selected species of Dytiscidae (Coleoptera) of central New York State. Dissertation. Cornell University, 207 pp.
- Fall, H. C. 1917. New Dytiscidae. J. N.Y. Entomol. Soc., 25:163–182.
- Fall, H. C. 1923. A revision of the North American species of *Hydroporus* and *Agaporus*. Mt. Vernon, N.Y., 129 pp.
- Guignot, F. 1942. Dix-septième note sur les Hydrocantheres. Soc. D'Etud. Sci. Nat. Vaucluse, 16–21.
- Gordon, R., and R. L. Post. 1965. North Dakota water beetles. North Dakota Insects—Publication No. 5. Department of Entomology, North Dakota State University, 53 pp.
- Gordon, R. 1969. A revision of the *niger-tenebrosus* group of *Hydroporus* (Coleoptera: Dytiscidae) in North America. Dissertation, North Dakota State University, 311 pp.
- Larson, D. 1975. The predaceous water beetles (Coleoptera: Dytiscidae) of Alberta: Systematics, natural history and distribution. Quaest. Entomol., 11:245–498.
- LeConte, J. 1855. Analytical table of the species of *Hydroporus* found in the United States with descriptions of new species. Proc. Acad. Nat. Sci. Phila., 7:290–299.
- Leech, H. B. 1949(1948). Some nearctic species of hydradephagid water beetles, new and old. (Coleoptera). Can. Entomol., 80:89–96.
- Leech, H. B. 1950. Addendum: Some nearctic species of hydradephagid water beetles, new and old. (Coleoptera). Can. Entomol., 81:233.
- Leech, H. B., and H. P. Chandler. 1955. Aquatic Coleoptera in Usinger, Aquatic insects of California. University of California Press. Berkeley + Los Angeles, 508 pp.
- Matta, J. F., and G. W. Wolfe. 1979. New species of nearctic *Hydroporus* (Coleoptera: Dytiscidae). Proc. Biol. Soc. Wash., 92:287–293.
- Say, T. 1823. Descriptions of insects of the families Carabici and Hydrocantheri of Latreille inhabiting North America. Trans. Amer. Philos. Soc., 2:1–108.
- Sharp, D. 1882. On aquatic carnivorous Coleoptera or Dytiscidae. Trans. Roy. Dublin Soc. 2, ser. 2:179–1003.
- Wolfe, G. W., and J. F. Matta. 1979. Three new species of *Hydroporus* (Coleoptera: Dytiscidae) from the southeastern United States. Proc. Entomol. Soc. Wash., 81:171–177.
- Wolfe, G. W., and J. F. Matta. 1981. Notes on nomenclature and classification of *Hydroporus* subgenera with the description of a new genus of Hydroporini (Coleoptera: Dytiscidae). Pan-Pacific Entomol., 57(1):149–175.
- Young, F. N. 1954. The water beetles of Florida. Univ. Florida Studies. Biol. Sci. Series, V. 5; ix + 238 pp.
- Zaitzev, Ph. 1907. Berichtigungen und Zusätze zu den Haliplidae, Dytiscidae und Gyrinidae in den neuesten Katalogen der Coleopteren. Rev. Russ. d'Entomol., 7:114–124.

Footnote

¹ Parts of this work were also completed during graduate study at the University of Tennessee and during a postdoctoral fellowship at the Smithsonian Institution.